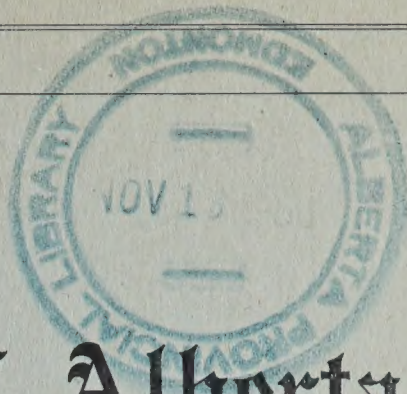


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The Province of Alberta

PETROLEUM AND NATURAL GAS CONSERVATION BOARD

IN THE MATTER OF THE GAS RESOURCES PRESERVATION ACT

AND IN THE MATTER of a Joint Hearing to determine various questions
relating to the proposed Export of Natural Gas from the Province of Alberta.

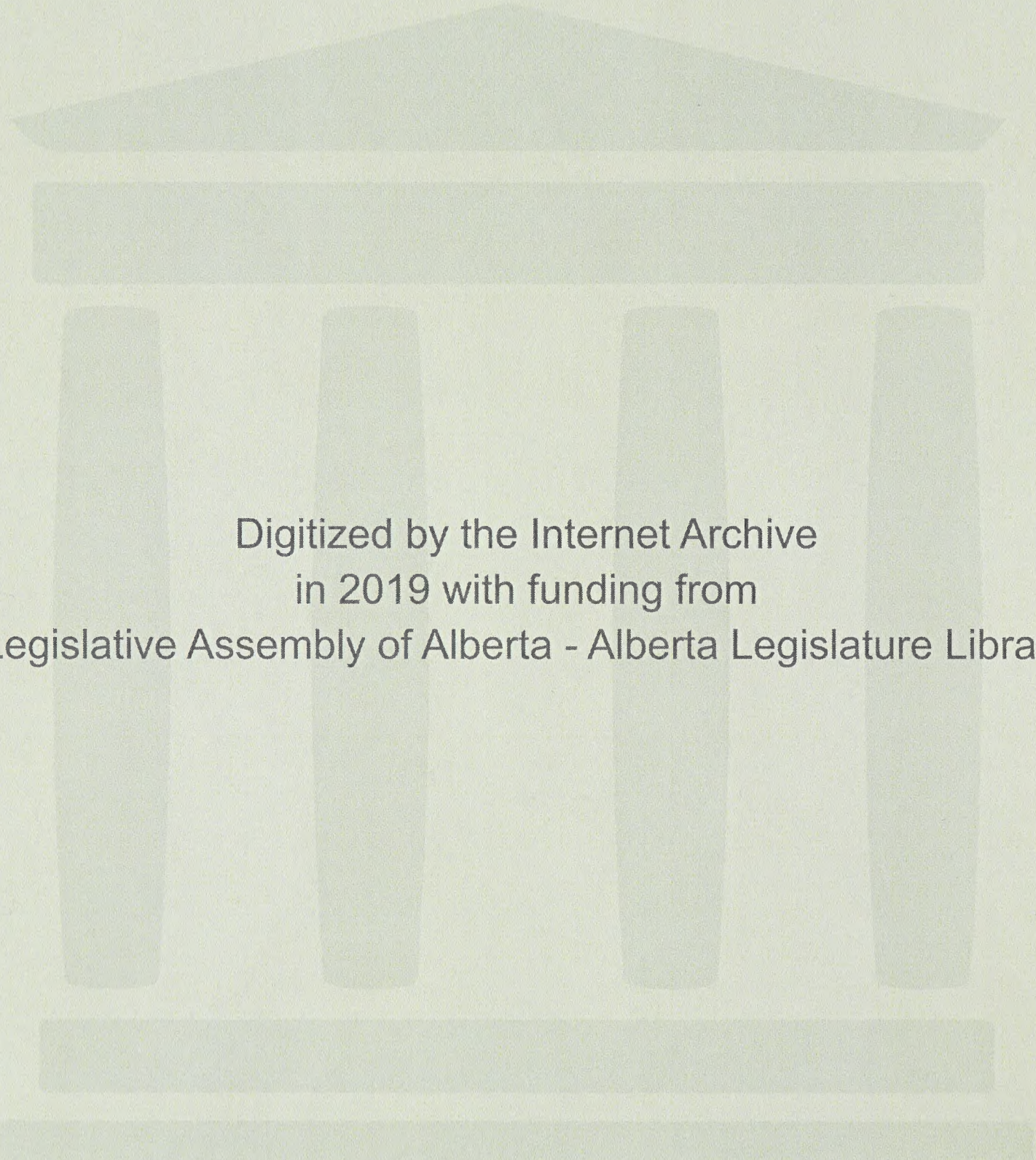
I. N. McKinnon Esq., Chairman

D. P. Goodall Esq.

Dr. G. W. Govier

Session: November 9, 1950.

Volume 9.



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I N D E X

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November 9th, 1950.

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Dr. A. W. Nauss.
Dir. Ex. by Mr. McDonald.

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November 9, 1950.

9 A.M. Session.

MR. S. B. SMITH: If we are to proceed with
Prairie Pipe Lines' submission I propose to call
Mr. Galloway first and then call Mr. Herring.

MR. C. E. SMITH: It is not your turn.

THE CHAIRMAN: We started with Westcoast yesterday
and they are midway through one of their exhibits at the
present time. So I think we had better carry on with that,
if you do not mind.

MR. S. B. SMITH: Do you intend to go on and finish
their evidence?

THE CHAIRMAN: At least I think we should carry
on with Dr. Nauss. I think it would be better for the
record if we could.

MR. S. B. SMITH: I am quite content. I had not
realized that Dr. Nauss' evidence has not been completed.

THE CHAIRMAN: No, it has not.

MR. S. B. SMITH: And it is then proposed that we
should follow Mr. Nauss?

THE CHAIRMAN: I think that we should have
Dr. Hetherington and keep the Westcoast evidence altogether.
Otherwise it is going to get all mixed up.

MR. S. B. SMITH: I am in some difficulty, sir,
because Mr. Herring has to leave the city tomorrow morning.
I do not know of course how long Dr. Hetherington's evidence
will take. If it is comparatively short no difficulty will
be entailed.

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Journal of the

Legislative Assembly of Alberta

Volume 5, 1950

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Dr. A. W. Nauss,
Dir. Ex. by Mr. McDonald.

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THE CHAIRMAN: We are going to sit this afternoon and we should be able to get through your own evidence and then the Westcoast.

MR. S. B. SMITH: Very well, sir.

DR. A. W. NAUSS (Recalled.)

Q BY MR. McDONALD: Dr. Nauss, yesterday at the adjournment you had finished your evidence with regard to Exhibit J-29. If you will turn to exhibit J-30, which is Table A revised as of November 6th, it is evident that you had completed J-29 after you had sent to the printers J-30. Now would you add to J-30, that is Table A revised, the additional proved and probable reserves which you have indicated in the Whitelaw area?

A We excluded from our revised Table A the Bluesky well as we were awaiting developments, final developments there. As a result I did not have the figures relating to the Bluesky well. To this figure of 6,570 billion cubic feet must be added 493 billion to take into consideration the proved and probable reserves outside of the proved area of Whitelaw. It brings the total to 7,063 billion, an addition of 270 billion from the proved area in the vicinity of the Bluesky well and 423 billion of the probable area delineated on the map which I included in Exhibit J-29. This figure of 7,063 billion is an increase of 946 billion since February 17th of this year. The largest increase is from the Whitelaw field.

Q Now you have added these figures to marketable gas, Dr. Nauss. Would you just check that and see if you should have added it to the proved reserves?

Mr. A. A. Hanson,
Director, FBI, Washington, D.C.

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THE DIRECTOR:

mean and we should be able to get some information
and then the Director.

Mr. E. E. Smith:

Mr. A. A. Hanson (Hanson):

BY MR. HANSON:

adjustment you had finished your assignment with regard to

Exhibit 1-10. If you will turn to Exhibit 1-10, which is

Table 4 revised as of November 1951, it is evident that you

had completed 4-15 after you had sent to the Director 4-10.

Now would you add to 4-10, that is Table 1 revised, the

additional proof and probable evidence which you have

collected at the Helsinki area?

It is exhibited from our records Table 1-10 which will

as we were making development, final assignment to the

is a review I also have the Director's letter to the

Helsinki area. In this review of 4-10, which was sent

was it added 4-10 which is the same as the review of

proof and probable evidence which is the review of

Helsinki. It shows the review of 4-10, which is the

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Will you then add that and if you will add

it to the review of the review of the review of the review

Dr. A. W. Nauss,
Dir. Ex. by Mr. McDonald.

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A No, the figure there is marketable gas.

Q The figures you have added?

A Yes, the figures we have added were marketable gas.

Q Now in your J-29, Dr. Nauss, you have included on page E, which is the portion of the Exhibit entitled "Other recent gas occurrences," you have included there the detailed information which was available to you with regard to the drilling of the Bluesky well to that point.

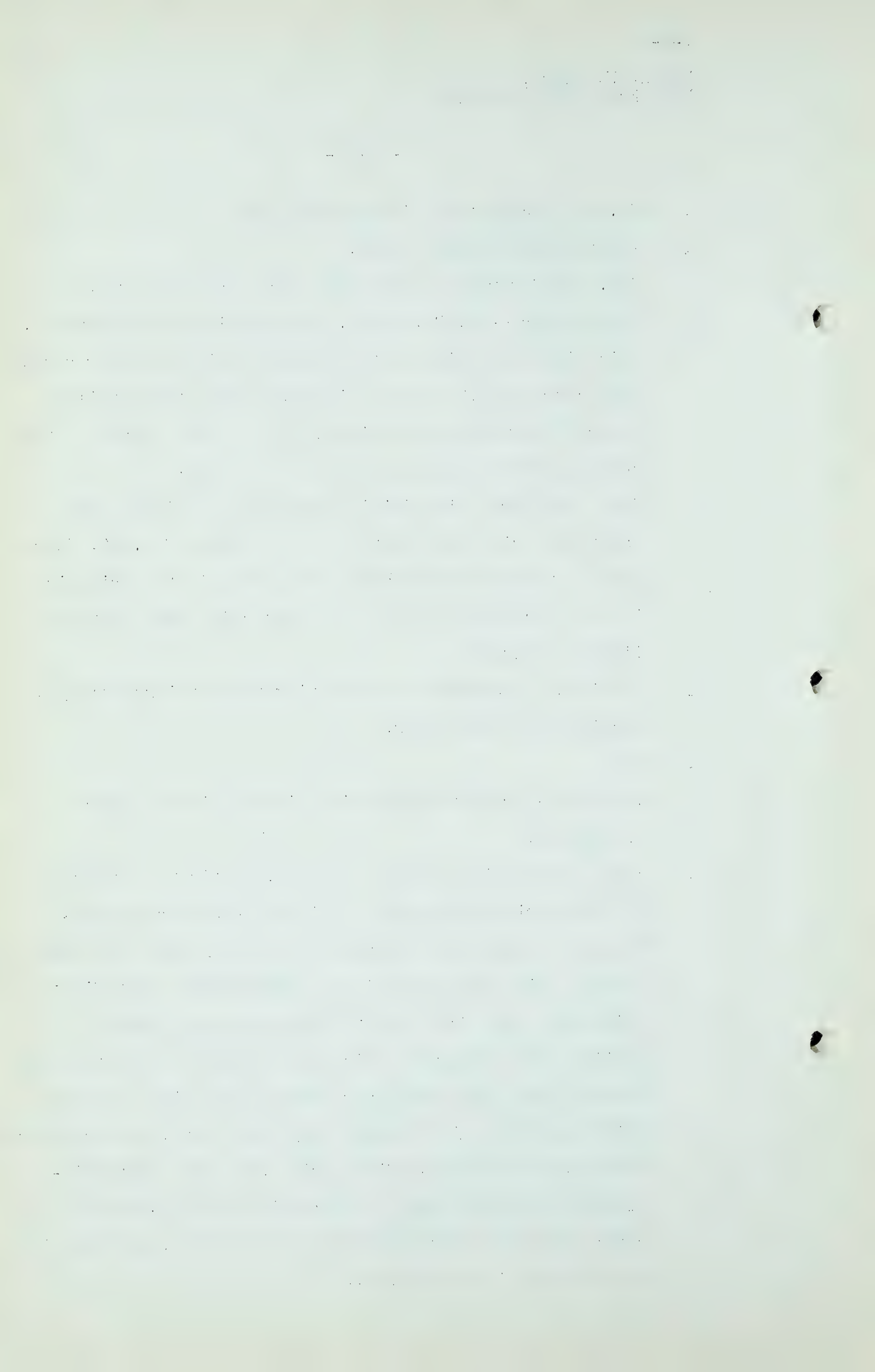
A Yes. The first nine drill stem tests are listed there and these drill stem tests are to a depth of 3,266. There was no other gas found below that depth in the triassic in the Bluesky well so that all the drill stem tests are listed on page F.

Q And it was subsequent to receiving these things that you received the electrolog?

A Yes.

Q Is there a production zone in this well in the Lower Cretaceous?

A Yes. In addition to that there is, the first of several of these drill stem tests are in the Lower Cretaceous. The top of the Lower Cretaceous is at 2734 and they had several drill stem tests in the upper part. That first drill stem test from 2729 to 2754 had a gas blow of 4 million 200 thousand cubic feet per day. The bottom hole pressure was 1150 pounds per square inch. Now the next drill stem test, just immediately below that, it encountered salt water so that the first drill stem test listed includes the entire zone. Now we did not calculate the reserves of that Lower Cretaceous occurrence, and that is not included in our Table A.



Dr. A. W. Nauss,
Dir. Ex. by Mr. McDonald.
Exam. by Mr. C. E. Smith.

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Q It is not included in Table A?

A No, but it is an important gas occurrence.

Q That is all I have, sir.

THE CHAIRMAN: Does anybody wish to cross-examine Dr. Nauss?

EXAMINATION BY MR. C. E. SMITH:

Q Doctor, I am not going to go through all the discussion we had once before with you. Incidentally, just one question with respect to this revised Table A, with regard to those additions you have made this morning. 493 billion added to the column called "Marketable Gas" is data which was presented or filed in your revised - included in J-29, do I understand it that way?

A It is included in J-29 but the data which was used for the entire 493 is the same as for the Whitelaw well, except for the thickness. We used the same pressures and porosities and connate water but of course the thickness of the Bluesky well is 70 feet rather than 170.

Q The acreage is shown on the map?

A Is shown on the map, yes.

Q Where you have those circles?

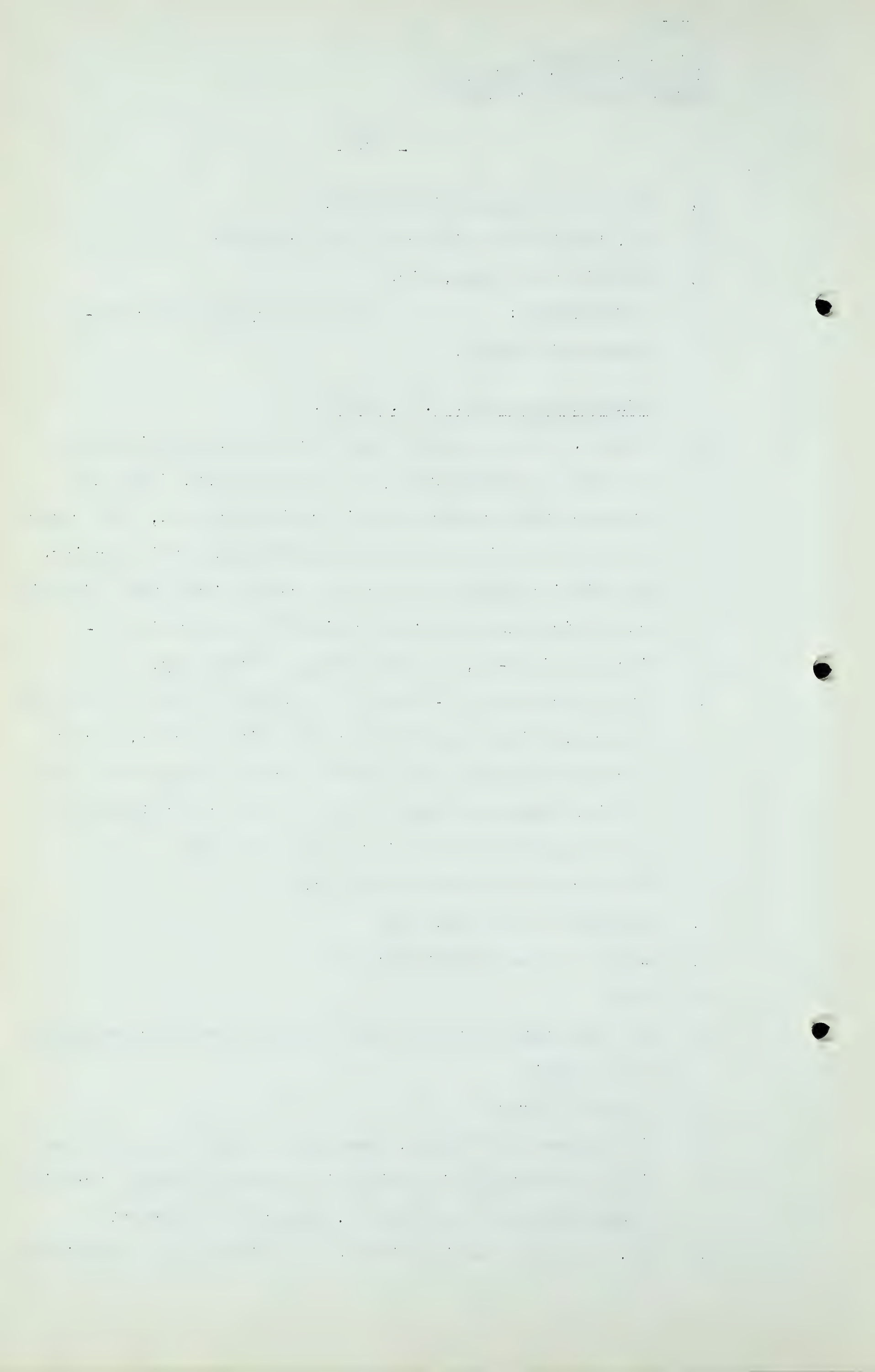
A Yes.

Q So that data can all be found from at least a combination of the two?

A That is correct.

Q If I understand Table A correctly the amount you now have in the Marketable Gas column is something about 1 trillion higher than the last Table A, is that not correct?

A No, it is 946 billion higher. Our first Table A submission



Dr. A. W. Nauss,
Exam. by Mr. C. E. Smith.

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had a figure of 6117 and the figure now is 7063.

Q 6117, yes. Roughly in that category?

A Yes.

Q Now I think I have just two questions to ask you. You are familiar with the submission that has been prepared by Westcoast and distributed but not yet submitted and actually given a number. It is headed "Deliverability of Alberta Natural Gas for Provincial and Export Supply." You are familiar with that, I take it?

A I won't say I am familiar with it, no.

Q Have you read it, the first two pages of it?

A I have not read the first two pages.

Q Then I will put it to you you have seen the map, have you?

A Yes, I have seen the map.

Q And if I remember correctly the map shows various areas in red, green, black and checkered and so on. Have you the map in front of you?

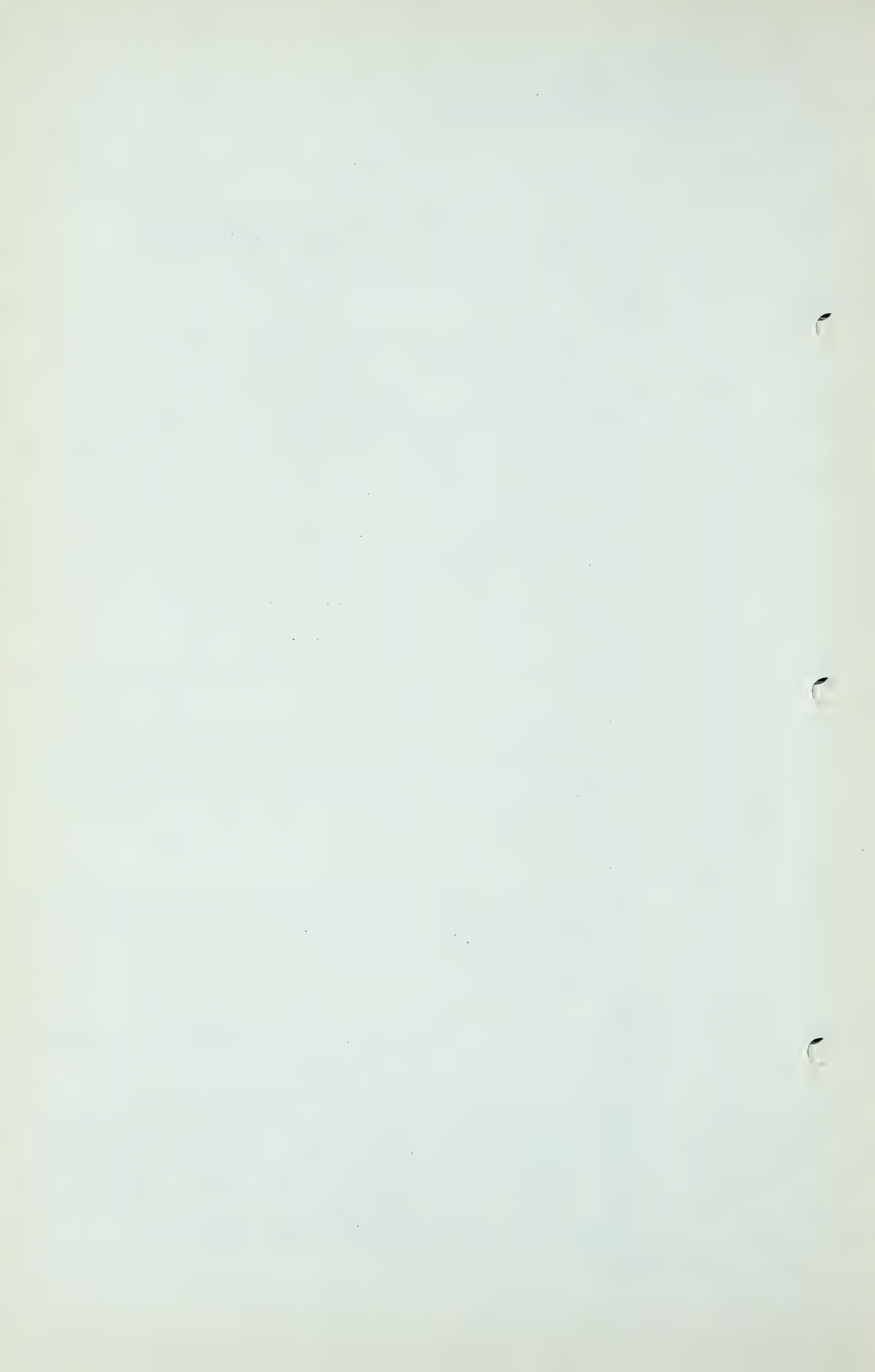
A Yes.

Q I want to refer you to the one portion of it called "Field in Northern Area," surrounded with a blue sort of a border, do you see that?

A Yes.

Q If I understand the submission to be submitted correctly Westcoast is of the opinion that they could carry out their present plan with regard to export of gas by getting their supply solely within the area marked in blue on that map. I think if my understanding is correct that is what I gather from this submission to be submitted?

A Yes.



A. W. Nauss,
Exam. by Mr. C.E. Smith.

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Q And is it your opinion, Doctor, that they can do that?

A I think there is sufficient gas within that boundary to supply their line, yes.

Q Will you go so far as to say there is sufficient pipe line gas to supply their lines and carry out their plans in your opinion?

A Yes, I think so.

Q And do not answer this one unless you want to. If you were advising the people that were putting up something over a hundred million dollars to carry out those plans, would you give them the same opinion?

A Yes, I would, and I would say they would want to do some drilling.

Q You would say in your opinion there is sufficient there but they would want to do some drilling? What for, to confirm the opinion or get some gas?

A To develop the gas.

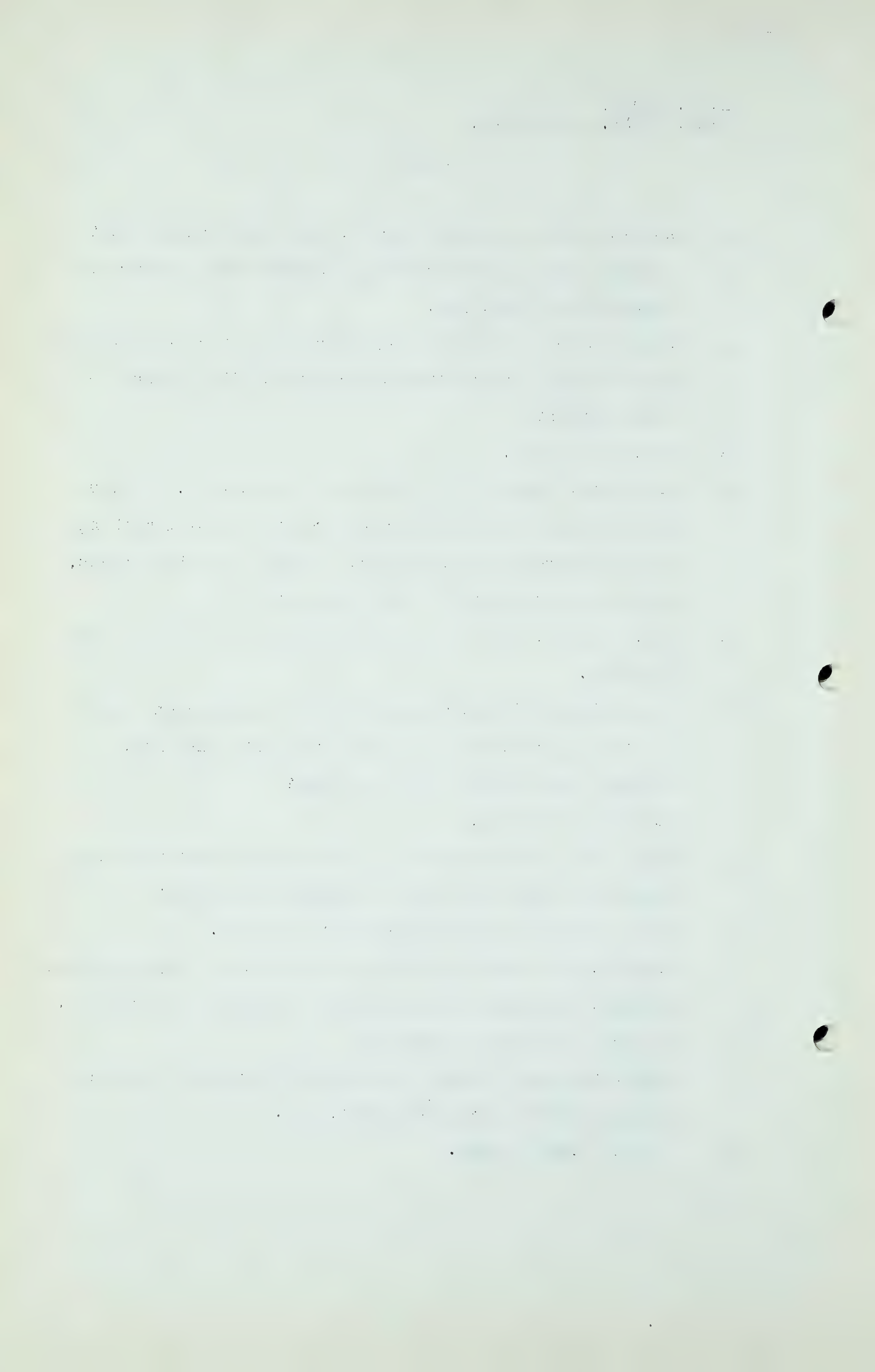
Q Would that be an addition to your opinion that we would need to do more drilling to confirm the opinion?

A Yes, it would be conditioned on my opinion.

Q That is, you would not want to see them, if they were your clients, spending that much money on present information. Is that a fair way to put it?

A They would want to have additional information from the drilling before they went ahead, yes.

Q I see. That is okay.



A. W. Nauss,
Exam. by Mr. D.P. McDonald.

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EXAMINATION BY MR. D.P. McDONALD:

Q If I might follow that along, sir. If you turn to page 29 of your Exhibit J-29, towards the end of the third paragraph, you deal with the number of wells that you think should be drilled and which in your opinion could prove up more than a trillion cubic feet?

A Yes. That paragraph reads:

"There is now drilling a well approximately eight and one-half miles east of the Bluesky well, and we understand a location for immediate drilling has been made some six miles north of the Whitelaw discovery well. The successful completion of either of these two wells could more than double the probable reserves of this area. Whereas additional drilling must be done in this area in order to determine the boundaries of the Whitelaw field, four to six wells whose locations were intelligently selected could prove up more than a trillion cubic feet of reserves with an attendant additional amount of probable reserve. These wells could and should be drilled within the next six months."

Q Now, since Mr. Smith has referred to this area encircled in blue on the exhibit which will be filed next, would you just refer to another significant discovery which you have in your recent gas occurrences, Pacific Valleyview No. 1, which is referred to on page F. Could you state briefly what you consider that discovery might indicate?

A Well, that gas occurrence, you will notice there are two

A. W. Nauss,
Exam. by Mr. D.P. McDonald.
Exam. by Dr. Govier.

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drill stem tests there, both at the same interval. The first two are of the same interval and the second one in which they recovered 340 feet was in a separate zone but both of those are in the Lower Cretaceous. That well confirms that the Lower Cretaceous is an excellent gas horizon as well as the Triassic.

MR. C.E. SMITH: Where would that be on the map if it were here, Mr. McDonald?

A That is southeast of Whitelaw.

Q MR. McDONALD: About 50 miles, is it, Dr. Nauss, Township 70?

A It is between Grand Prairie and Lesser Slave Lake.

MR. C.E. SMITH: Is that description right on page F?

Q MR. McDONALD: Lsd 11, Section 33, Township 70.

A That should not be west of the 4th. It should be west of the 5th, about half way between Grand Prairie and Lesser Slave Lake.

EXAMINATION BY DR. GOVIER:

Q Dr. Nauss, there seems to be a few blanks in this table. I wonder if you could give us the figure that should be inserted under Redwater D-3? You have a number of items blank, I imagine because you calculated those by an oil reserve method?

A Yes, that is right.

Q Do you just want us to leave that blank with the note that this is an oil reserve calculation?

A. W. Nauss,
Exam. by Dr. Govier.

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A Yes, that is an oil reserve calculation.

Q And the same is true of Golden Spike, is it?

A That is correct.

Q Now, under Golden Spike I notice you have a number of reserves to 100 pounds of 50, and 50 times 80% is 40, and yet you have 25 entered under marketable gas. Is there a correction there?

A I think that was an error. No change has been made in Golden Spike so there is an error in typing. That should not be 80, that should be 50%.

Q Strike out the 80 and put in 50%?

A Yes.

Q Vermilion Sparky is by pressure decline. Under Stettler for both D-2 and D-3 there are two blanks under the deviation factor. Is there anything to be put there?

A A deviation factor could be inserted there but the D-2 and D-3 again is an oil reserve calculation.

Q And under Dunmore you have Bow Island formation, then there is another line below that. What formation is that, is that also Bow Island?

A In Dunmore there has been no change over the previous calculation.

Q Are these two Bow Island sands each 7 feet thick?

MR. C.E. SMITH: In the previous one you had Bow Island and Ellis sand.

A That is what it should be, Ellis.

Q DR. GOVIER: And there should be a per cent marketable factor, too, in there? And in Jarvie am I right in assuming that the final figure of 31 is a

A. W. Nauss,
Exam. by Dr. Govier.

- 784 -

composite of the figure for the Viking and the Basal Quartz sands?

A Yes, those three figures should be added up.

Q We could bracket the three together?

A That is the way I had it on the original, with the bracket over them.

Q And Brooks and Milk River is by pressure decline method. Then the Sunburst sand, you have no entry under any of the columns, Dr. Nauss. Was that an unintentional omission?

A I believe on my original I had no entry under that, pressure decline.

Q For the Brooks-Princess also - -

A That is copied off the previous sheet.

MR. McDONALD: Yes, they both are itemized 4, which is pressure decline method.

DR. GOVIER: That is fine.

MR. McDONALD: The data in support of that, Dr. Govier, I think is in the first submission.

DR. GOVIER: In the first submission.

I just do not happen to have a copy of it here.

MR. McDONALD: I might say, too, sir, with regard to the data for Redwater it is on page 13 of J-29 and some additional data with regard to Stettler is on page 23 of J-25.

Q DR. GOVIER: Under Medicine Hat, Dr. Nauss, there are a few blanks. Is there any explanation there?

A That was also pressure decline.

Q That is by pressure decline?

A. W. Nauss,
Exam. by Dr. Govier.

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Q Did you work out the reserve per acre foot for Whitelaw?

A The reserve per acre foot. I did not divide it out but it is a simple matter of dividing the reserve.

Q That is fine. And for Brandi there are no entries under acreage or thickness?

A The reason for that is that we took a seismic map, converted it to depth, and drew up a contour map on the basis of the elevation that the well hit the top of the reservoir rock, then we assumed that the water level encountered in the well was the same over the entire structure and we isopached that and we obtained the volume directly. The average thickness is about 11 feet and the area is 1,000 acres approximately.

Q Now, Dr. Nauss, the Board of course appreciates why you want to add to this table in the light of recent discoveries. I have been wondering, though, whether you have also gone over some of the recent dry holes and whether in the light of that there are any subtractions which might be made. What I had in mind particularly is the evidence that Mr. Davis brought out to the effect that there had been some disappointment in Viking-Kinsella and I wondered whether you had an opportunity to review your estimate of Viking-Kinsella in the light of recent developments.

A I did not review the Viking-Kinsella field.

Q Did you review any of your reserves in the light of developments that might tend to lower the size of these reserves?

A I did not make a thorough re-study of all the fields so that there is a possibility that some of the fields might be revised downward, as you suggest.

A. W. Nauss,
Exam. by Dr. Govier.
C. R. Hetherington,
Exam. by Mr. McDonald.

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Q Without having made a thorough study, Dr. Nauss, do you believe that there might be any significant downward revision or do you think it would be very small, if it were made?

A I think any downward revision would be very small.

Q Fine. Thanks very much.

THE CHAIRMAN:

Thanks, Doctor.

CHARLES R. HETHERINGTON

having been first duly sworn, examined by Mr. McDonald, testified as follows:

Q I submit now, sir, "The Deliverability of Alberta Natural Gas for Provincial and Export Supply" submitted on behalf of Westcoast Transmission Company Limited, dated October 24th, 1950.

THE CHAIRMAN:

J-31.

DELIVERABILITY OF ALBERTA
NATURAL GAS FOR PROVINCIAL
AND EXPORT SUPPLY SUBMITTED
BY WESTCOAST TRANSMISSION
COMPANY LIMITED DATED OCTOBER
24th, 1950, MARKED EXHIBIT
J-31.

Q MR. McDONALD: Now, Dr. Hetherington, you have prepared this report. If you would proceed to present it. It is a short report, Mr. Chairman, insofar as the wording is concerned and I think if Dr. Hetherington proceeds to read it.

A This report is in respect to the deliverability of Alberta Natural Gas for Provincial and Export Supply and is being presented pursuant to the request of the Board which created this Joint Hearing, and is presented in an attempt

C. R. Hetherington,
Exam. by Mr. McDonald.

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to provide the Board with our best estimates of the present and future deliverability of the various fields in Alberta and how that deliverability can be employed to supply long term Provincial supply and long term export supply. This report is really a compilation of a number of reports I have presented in the past on this same subject bringing those same procedures up-to-date in the light of increased reserves and in some cases, decreased reserves, also bringing the information and assumptions used up-to-date in the light of additional information that has been presented. For example, the Provincial requirements as presented by Northwestern Utilities and Canadian Western in their submission in the Westcoast Transmission Company case. The well characteristics have been altered somewhat as shown in the charts attached to this exhibit to reflect changes, one in particular the Jumping Pound and Pincher Creek formation pressure gas in place. Charts have been correctly plotted and the charts for those two fields supersede the previous charts. I am reading this short text now.

1. General

In its hearing before the Petroleum and Natural Gas Conservation Board of Alberta, Westcoast Transmission Company, Limited, presented an Exhibit (No. 99, "Schedule for Gas Production for Provincial and Export Pipe Lines") showing a 30-year supply of deliverable gas to meet Provincial requirements and a 20-year supply of deliverable gas for export to meet the forecast requirements of Westcoast. The plan outlined in

C. R. Hetherington,
Exam. by Mr. McDonald.

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Exhibit No. 99 contemplated the common withdrawal for Provincial and export use from all suitable gas fields in Alberta except those under contract or commitment with Provincial utilities. The results were based on the then known gas reserves.

Subsequent to the time of that submission, Provincial gas reserves as a result of new discoveries have increased sufficiently that export need not depend upon common withdrawal from gas reserves in the Provincial supply area. Instead, sufficient gas reserves north and west of Edmonton in the area of the main line of Westcoast Transmission Company, are available to support export to the West Coast. Deliverable gas reserves in the areas contiguous to Provincial gas utility systems are adequate for estimated 30-year or 50-year Provincial requirements. In addition, there is a surplus of deliverable gas in excess of 30-year or 50-year Provincial requirements from the areas contiguous to Provincial systems.

This report presents and summarizes gas deliverability calculations in support of these conclusions. Deliverability schedules are given which detail by fields or areas the manner in which Westcoast proposes:

- (a) that present and future annual and peak load requirements of the Province may be met from the existing reserves of gas for both 30 and 50 years.
- (b) that surplus gas from these areas in excess of 30-year and 50-year requirements may be produced, detailing the estimated surplus available from each field.

1. Introduction

2. Methodology

3. Results

4. Discussion

5. Conclusion

6. References

7. Appendix

8. Acknowledgements

9. Bibliography

10. Index

11. Glossary

12. Summary

13. Abstract

14. Introduction

15. Methodology

16. Results

17. Discussion

18. Conclusion

C. R. Hetherington,
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- (c) that the present and future annual and peak load requirements of the areas to be served outside the Province may be met from the existing reserves of gas for 20 years.

(Go to page 790)

C. R. Hetherington,
Dir. Ex. by Mr. McDonald

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The estimated present and future deliverability of gas from each field or area within economic reach of a major Provincial or export outlet is detailed by years in these schedules. Estimated present and future deliverability, both open flow and well head, is given by the attached chart showing well deliverability characteristic for a typical well in each of these fields or areas. Pertinent geological and engineering data are summarized in Table Number 6.

2. Classification of Gas Reserves

Gas reserves may be classified by areas geographically contiguous to and remote from Provincial service areas. The following map and Table No. 1 show this grouping which is summarized as follows:

In the summary I would like to make a correction. The Cross Hatch indicates the unallocated areas, and the Black indicates small local areas.

| <u>Map Colour Code</u> | <u>Area</u> |
|------------------------|-----------------------------|
| Green | Canadian Western Area |
| Red | Northwestern Utilities Area |
| Cross Hatch | Unallocated Areas |
| Black | Small Local Areas |
| Blue | Northern Area |

Referring to the map for just a second. The fields in the Canadian Western Area and the Northwestern Utilities areas so classified were selected on the basis of their suitability for the supply of gas both as to need of supply and to promote conservation. The gas fields are of a nature that would probably be

C. R. Hetherington,
Dir. Ex. by Mr. McDonald

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used whether there was export or not, particularly in the case of the Canadian Western area, and as additional gas is required why the gas fields which have the green-outlined area are the logical fields from which Canadian Western would draw, irrespective of export. That same statement is generally true for the areas outlined in red for the Northwestern Utilities area.

I want to make another minor correction on this map. The Lloydminster field is shown as Unallocated, at least part of it should be shown as fields in Small Local Areas. Even after doing this thing several times it is not 100% right.

Fields as tabulated in Table No. 1 may be used to supply present and future requirements of the respective areas. Small local areas are provided for by the gas fields included in the "Small Local Areas" classification. The Map shows all towns of 1,000 population or more and indicates present source of gas supply, if any.

In that connection I refer for the background to Mr. C. R. Sample's presentation in the Westcoast Transmission Company case in which he tabulated towns of 1,000 population or more, indicated their present gas supply, if any, and estimated their 50-year requirements.

The Northern Area is suitable for a supply of gas for Westcoast Transmission Company.

Q Would you go then to Table 1 and carry on and discuss Table 2, and indicate the use of the other Tables?

A Table 1 is a summary table listing the total marketable

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gas in the billions of cubic feet, at 14.4 pounds per square inch absolute, and 60° Fahrenheit temperature. The figures are substantially taken from Dr. Nauss's Table A, Exhibit J.....

Q 30.

AExhibit J-30. In the case of Whitelaw, at the time that this submission was made complete data were not available on the field, as they are not available now. At that time a preliminary estimate was made, and it is indicated here by a footnote that the estimate is based on incomplete information as of the date of this writing, indicating that Whitelaw would have at least a trillion cubic feet. In this Summary and throughout this Table and this exhibit all information is based on that assumption, which is an assumption on incomplete information which is, at least, partially substantiated as of this time.

The Whitelaw field is in a northern area which it is proposed to be used for, proposed to be used by Westcoast Transmission Company, and, accordingly, the correctness of that estimate at this time is not of the same magnitude or importance as correctness of the estimates in the Canadian Western and Northwestern Utilities areas where the Provincial supply would depend upon correct estimates at this time.

As Dr. Nauss pointed out, additional drilling will be required in Whitelaw to prove that assumption.

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3. Schedules of Gas Production

The attached schedules of gas production detail by years the deliverability of gas from each field to each source of consumption.

Table No. 3 - Schedule of Gas Production -
Deliverability of 30-year Provincial Requirements and
Surplus from Canadian Western and
Northwestern Utilities Areas.

Please refer to Table 3, being a series of nine pages. This Table shows the deliverability calculations by years to the year 1957, and then by five and ten-year periods thereafter for a total of 30 years.

The Table shows the source and disposition of gas from each of the fields in the Canadian Western and Northwestern Utilities Areas to supply the Provincial requirements within those two areas, and to supply a 20-year surplus. In other words, the Table shows how Provincial requirements can be met for 30 years from these fields, and indicates how much additional gas over and above Provincial requirements would be excess for a period of 20 years. In estimating the amount of surplus gas it was necessary, of course, to consider peak load. For the purpose of this submission I have assumed that the additional gas would be withdrawn at 70% load factor each year, - Canadian Western requirements. These yearly estimates of gas requirements and allocation of takes and peak loads reflect a proposed allocation submitted by the Turner Valley Gas Committee to the Conservation Board in respect of Canadian Western Natural Gas Company takes and the submission of January

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27th, 1950, of Northwestern Utilities, Limited, in respect of that Company's takes through 1960. Requirements beyond the fifth year (1957) are taken at the estimated 1960 rate of consumption.

Referring again to Table 3, the Table, I believe, does not require a detailed explanation beyond that already given in the case of Westcoast Transmission Company, and heard by most of us present today.

The average daily dry gas is shown in the first four columns for Canadian Western, Northwestern Utilities, the additional supply and then the total. The maximum daily dry gas is shown in the next four columns for these same outlets. The next column entitled "Total Production," gas production in billions of cubic feet over the period, and then since 1949. Take Page 1 of Table 3, that is for the year 1953, there has been certain prior consumption, or there will be prior consumption in Turner Valley, Jumping Pound, Foremost, Viking-Kinsella, Leduc-Woodbend, and Golden Spike, and that prior consumption is indicated as the difference between the production during this period and the production since 1949.

The next column entitled "Average Well MMCF Per Day" gas calculated open flow and the average well in each of the gas fields, I mean, of the average well in each of the gas fields, which is expected will steady at the end of the period after the quantity of gas shown has been withdrawn. The allowable production is taken at a straight 25% of the open flow

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times a shrinkage factor. The shrinkage factor in each field is different and is summarized in Table 6 at the end of the Report. By dividing the allowable into the maximum daily dry gas, the maximum number of wells required at the end of the period is computed, and that is shown in the last column. In no case ^a are wells spaced closer than 640 acres.

Each page of this Table is made up in the same form through 1957 by years, and then by 5-year periods through 1972, then for a 10-year period to 1982.

I would like now to refer to the next Table, Table 4. Table 4 gives the schedule of gas production deliverability of 50-year Provincial requirements and a surplus from Canadian Western and North-western Utilities areas. This Table 4 is made up in exactly the same fashion as was Table 3, except that the results will be different. In order to supply Provincial requirements for 50 years, the additional gas available for other uses other than Provincial requirements is less than if 30 years is set as the criterion for establishing long-term Provincial requirements. The Table is made up by years to 1957 and then by five and ten year periods to the year 2000.

The next table is Number 5, "Twenty-Year Schedule of Gas Production for Westcoast Transmission Company Project." This Table, although in different form from Tables 3 and 4, is made up in exactly the same fashion and contains the same information for the deliverability of gas from the Northern Area to

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meet the requirements of Westcoast Transmission Company for export. These deliverability Tables are all summarized in Table 2. Table 2 follows Page 9 of the Report.

Table 2 is a summary of gas production schedules showing the amount of surplus gas in excess of Provincial requirements. This Table is presented on a 30-year and a 50-year basis for establishing requirements. The gas fields of Alberta listed as suitable for use by Dr. Nauss in his geological reports are listed along the left side of the Table and are classified in accordance with the aforementioned classification into Canadian Western Area, the Northwestern Utilities Area, Small Local Areas, Unallocated Areas, and the Northern Area.

Q MR. C. E. SMITH: What Table is that that you are referring to?

A Table 2, following Page 9.

Q MR. McDONALD: If you will wait until they find it. It is a long Table, Mr. Smith. Possibly you will start your discussion of this Table again, Dr. Hetherington?

A Yes.

Q So that counsel can follow it?

A This Table summarizes all of the voluminous deliverability Tables that I have just touched on lightly. The gas fields listed by Dr. Nauss as suitable for supply of gas are all listed along the lefthand side of the page. They are listed in my classification as to Canadian Western Area, Northwestern Utilities Area, Small Local

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Areas, Unallocated Areas and the Northern Area. The far righthand column of the page shows the Total Marketable Reserves as listed by Dr. Nauss with the exception of Whitelaw, which is taken at 1 trillion cubic feet.

.....

CROSS-EXAMINATION BY MR. FENERTY:

- Q Dr. Hetherington, just while you are there, so that I can follow it, what is the significance of the amount of surplus gas in excess of Provincial requirements? Now, I understand that the surplus with reference to certain areas shows up as export, but what is the significance of surplus gas in those areas which you have, in effect, allocated to Calgary and Edmonton?
- A That is the gas that could be delivered over a 20-year period in excess of Provincial requirements for 30 years in the one case and 50 years in the second case.
- Q But you do not do anything with it in here?
- A I do not do anything with it in here, that is just a measure of how much gas could be taken for other uses should it be desired.
- Q That is all I wanted to get, thank you, Dr. Hetherington.
- A Now, this Table is split into two sections. The first section comprising the first three columns, is a summary of deliverable gas on the basis that 30 years is the criterion for establishing a long-term Provincial supply. If 30 years is the criterion then Canadian Western would require 992 billion cubic feet over that 30-year period, which would be deliverable as shown on this Table,

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Turner Valley 251 billion, Jumping Pound 366 billion, Pincher Creek 366 billion, and the Foremost, including the California Standard area, of 9 billion. Now, over and above that gas there could be produced from the number of wells that could be drilled 573 billion cubic feet, taking Pincher Creek, Princess-Patricia, Pendant d'Oreille and Manyberries. The remaining gas then is the difference between that produced for local supply, that which could be produced for other uses, and that which is needed for local systems. That is shown as gas deliverable in the future.

Let us take the case of Pincher Creek as an illustration. 366 billion is required for Canadian Western in the 30-year period. There could be delivered in addition 184 billion over the 30-year period while still meeting the Canadian Western Peak load in the 30th year. Mr. Sample estimates that about 17 billion cubic feet of gas from Pincher Creek is needed for Blairmore and these other towns, Coleman and the other towns in that area, the Town of Pincher Creek.

Q MR. McDONALD: Was that 17 billion?

A 17 billion. That is a period of 50 years.

Q 50 years?

A I have just stuck with 50 years in the requirements for those local systems.

(Go to Page 799).

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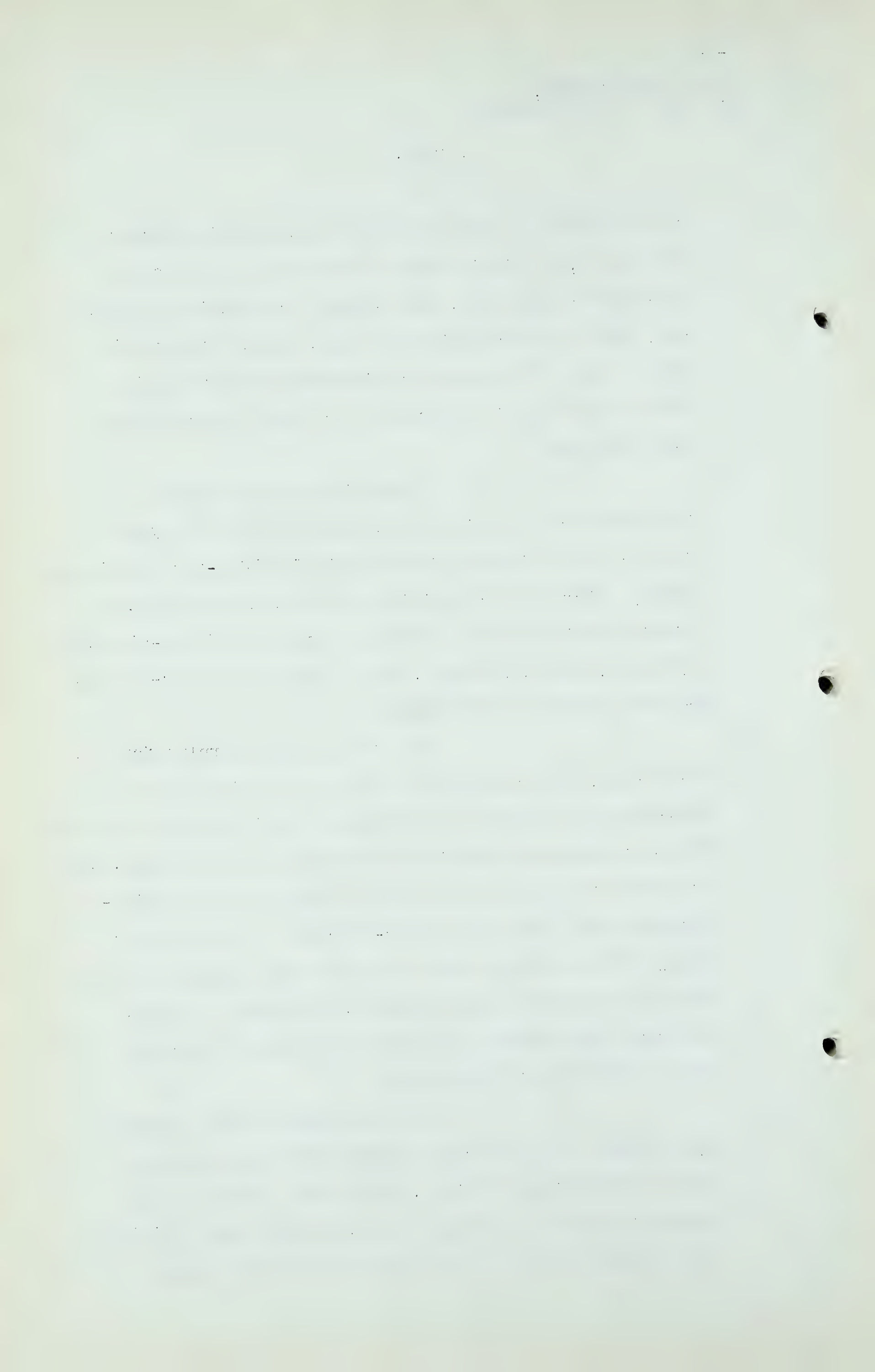
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So then from the total marketable reserves in Pincher Creek of 1,252 billion cubic feet there is required 17 billion for local use, 366 billion for Canadian Western use, 184 for other deliverable gas, whether the gas is used or not. That leaves a difference of 685 billion cubic feet which is deliverable in future years beyond the 30th year.

Now going to Northwestern Utilities area. It is on the same basis that 30 years is to be the criterion for establishing long-term Provincial supply. Northwestern Utilities there will require 1101 billion cubic feet to be obtained from the Viking-Kinsella, Provost, Leduc.-Woodbend, Golden Spike and Leduc-Woodbend gas cap, Stettler and Redwater.

Now the only gas surplus from that area, over and above the 30 year requirement of Northwestern Utilities is 52 billion cubic feet from Provost. There is required certain gas for small local systems, which is shown in the next to the last column of 9 at Viking-Kinsella and 3 from the Leduc-Woodbend. The difference between the total marketable gas and that required for the Province and others for 20 years, the surplus is shown as future deliverable gas in the Northwestern Utilities area of 662 billion cubic feet.

The next classification is Small Local Areas. In the case of small local areas situated near an existing gas field, whether that gas field was supplying gas to the town or not, the entire gas field has been allocated to the use of those small local areas.

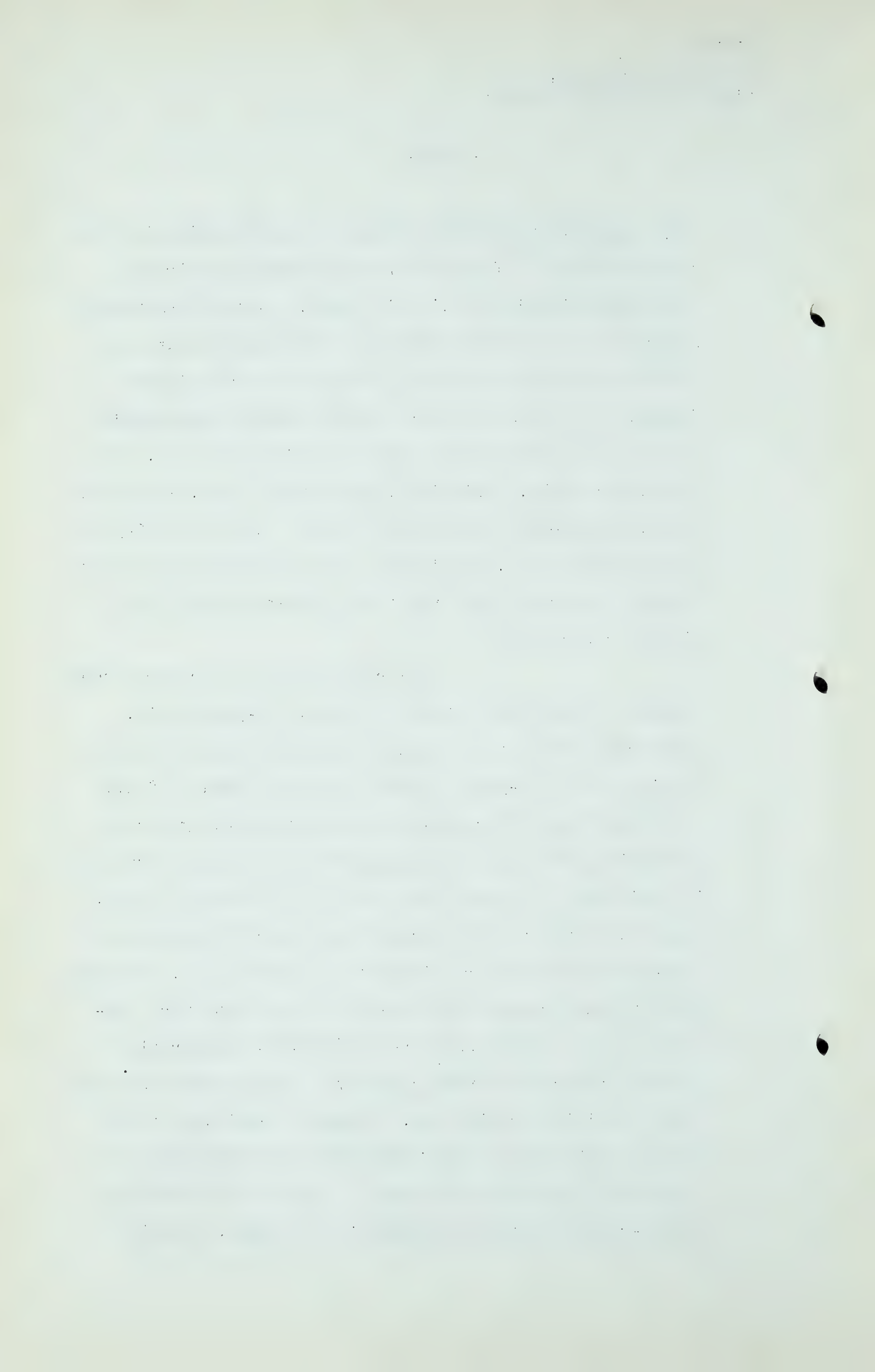


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They aggregate marketable reserves of 381 billion in that classification. The next area is Unallocated Areas. This classification has, as is shown, a total marketable reserve of 96 billion cubic feet. The Northern Area is the area which is suitable for Westcoast Transmission Company. I have shown there how Westcoast requirements could be met for a total of 20 years from Whitelaw, Pouce Coupe, Chip Lake, Morinville, Picardville Area, Athabasca, Boyle, Bailey-Long Island and Jarvie. Westcoast 20-year requirements are 1,461 billion cubic feet and that leaves future deliverable gas from that Northern Area of 658 billion cubic feet.

Now referring to the centre three columns of this Table which is headed "50-year Basis, Deliverable Gas," these columns are explained in the same fashion as the 30-year columns and are a summary of all the deliverability schedules showing where the gas can be obtained for each of the market areas and how much gas is available as surplus from each of those market areas, should 50 years be selected as the basis for establishing long-term Provincial requirements. In this case, Canadian Western would require 1526 billion cubic feet over a 50-year period. There would be available a deliverable surplus in excess of that quantity the Canadian Western area 351 billion cubic feet, leaving a remainder of 944 billion cubic feet of gas which would be deliverable in the future beyond the 50 years. You will note that in the so-called surplus to others for 20 years, that is



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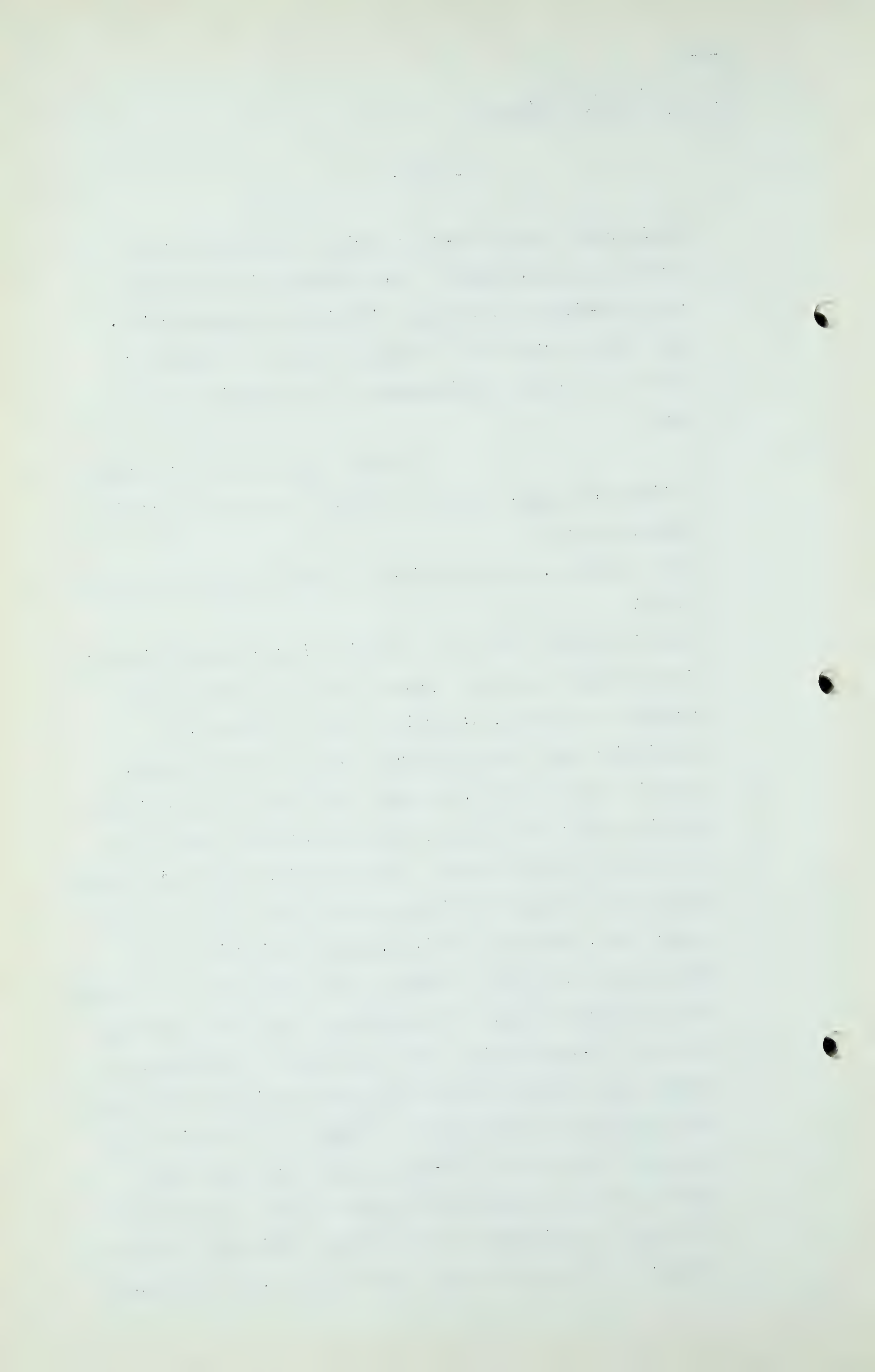
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deliverable over a 20-year period in excess of the Provincial requirements. That surplus is only from Princess-Patricia, Pendant d'Oreille and Manyberries. The entire production of Pincher Creek is required to meet the 50-year requirements of the Canadian Western area.

I would like to refer to Table 4 on the last page. That is page 11. Under the Canadian Western area.

Q Just a moment, Dr. Hetherington. That is Table 4 of Page 11 of 11?

A That is right. Under the Canadian Western Area, Pincher Creek during the last 7 years to the year 2000 would produce an average, according to this schedule, of 60 million cubic feet per day. During the 50th year, that is the year 2000, the peak load would be down to 46 million cubic feet per day from the 23 wells that could be drilled in that field. This is after production during that 50 year period of 773.5 billion cubic feet. On the other hand, Princess Patricia, Pendant d'Oreille and Manyberries are able to supply their peak load requirements after a certain amount of surplus gas has been withdrawn over the 20-year period. The last year of withdrawal of surplus gas shown in any of these tables is the 20th year. That is shown on this Table 4 on Page 8. You will note on page 8 this for the 20-year period from 1953, that there is shown an additional amount of gas over and above Provincial requirements of 28 million cubic feet per day average. Turning the page now to page 9, and thereafter



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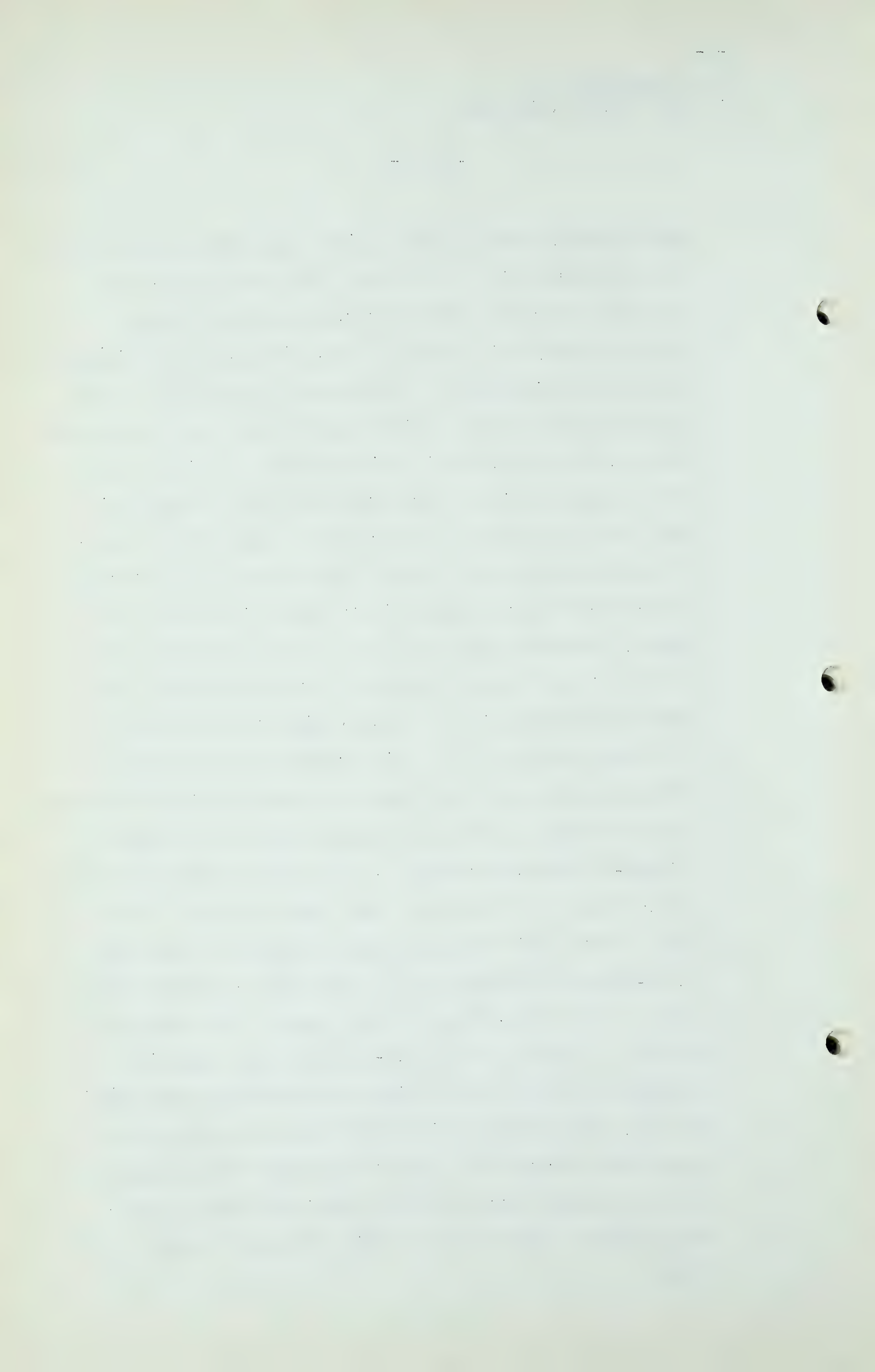
additional gas is dropped out. In all cases the additional gas has been taken only for 20 years.

Turning back to Table 2, the Summary table, if 50 years is to be the criterion for establishing long-term Provincial supply, Northwestern Utilities will require 1685 billion cubic feet to be supplied from the gas fields, as indicated. In that event there is no surplus from that area over and above Provincial requirements. This submission does not contemplate the use of storage in the gas field area to meet peak loads. I believe by using storage fields for - I should say except in the case of Bow Island and Foremost - but if some other field in the northern area were used for storage there would be some surplus deliverable gas from the Northwestern Utilities area. In lieu of storage, however, all of the wells are required in the 50th year to meet Provincial requirements. Then coming back to the report on Table number 6. That precedes the charts. This Table is titled "Summarized Basic Geological and Deliverability Data," and lists the information used in calculating the deliverability characteristics that might be expected from the gas wells in the future. I would like to point out that I have attempted in all cases to be conservative in estimating the amount of gas that could be withdrawn in any 24-hour period in the future from these gas wells in view of the admitted uncertainty in calculating production into the distant future. Where data are available which indicate that the so-called delivery curve has a high slope, one which might not ordinarily be

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considered accurate, I have still stuck with the data and used that slope in the interests of being conservative. The use of a deliverability curve slope such as say 1.15 as employed in Jumping Pound, will result in estimates of future deliverability considerably larger than if the slope of 0.85 is used as is general in most gas reservoirs. Where data were available which indicated that the slope of the deliverability curve was more nearly consistent with the data from the United States, which is now 0.85, I have used the actual data. Where there was uncertainty or absence of data such as in the case of Athabasca and Boyle, I have used the slope of 1 rather than the slope of 0.85 in order not to overstate the amount of gas that could be obtained in the future. Similarly where data have been available to me with respect to the average original open flow I have made an attempt to be conservative and not estimate that open flow too high. In the case of Viking-Kinsella, for example, I used the average open flow of 10 million cubic feet per day. More than half of the wells in that field have an open flow greater than that. A 30-minute open flow, most of the wells is greater than that. The one-day open flow of most of the wells is greater. I have used the 10-day open flow weighted average to arrive at the figure of 10 million cubic feet per day. In all probability peak loads are going to be such that certain wells could be used for shorter periods than 10 days and that the open flow under which a well will operate will be greater than 10 million cubic feet.



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In the case of the Whitelaw well I have used the best estimates of Dr. Nauss as to the probable open flow of that well. The drill stem tests developed more than 50 million cubic feet per day for this first well. We felt that there was probably certain overlapping of those drill stem tests and accordingly used the figure of 50 million cubic feet per day.

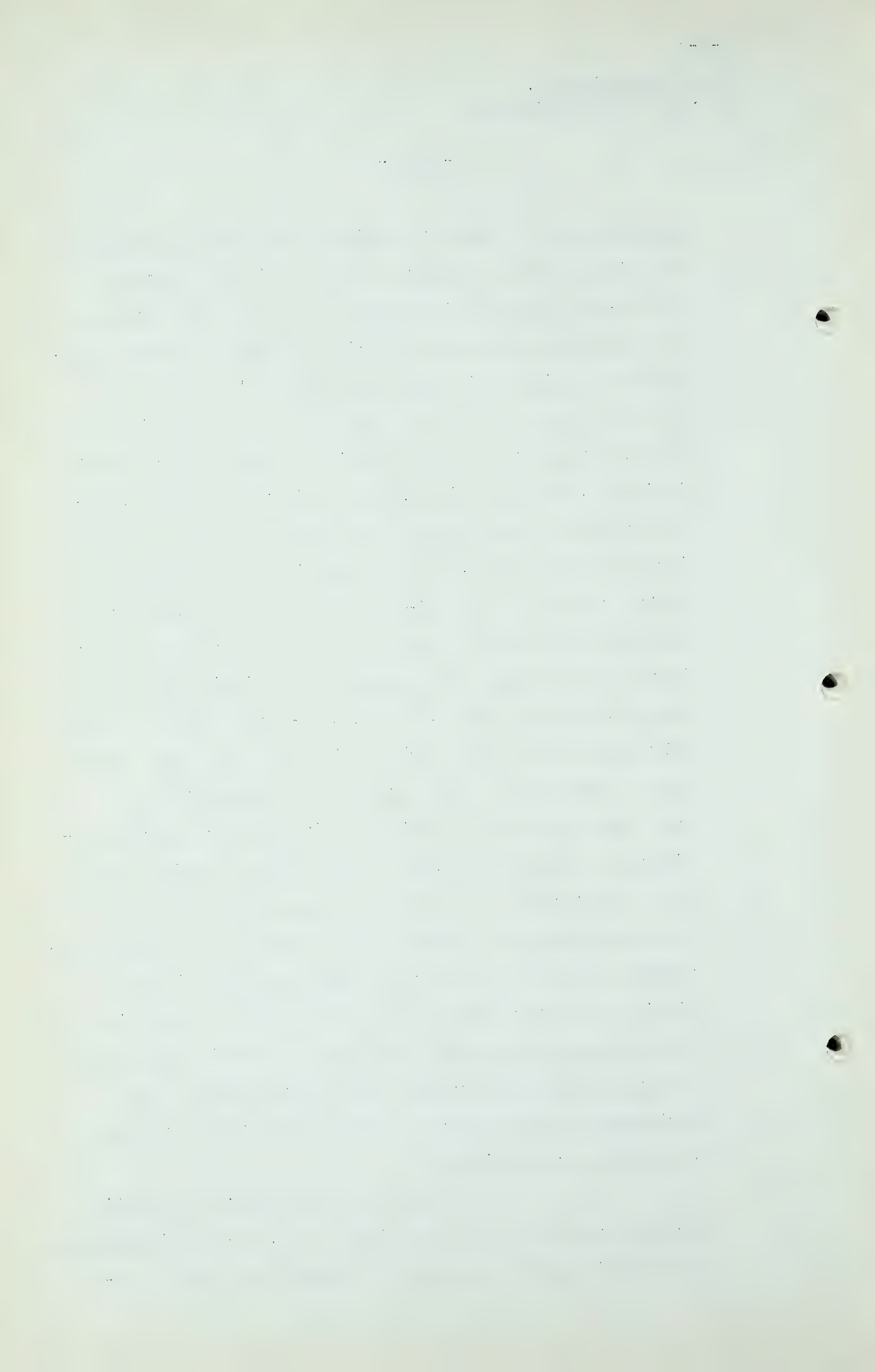
Following this Table 6 there are a number of charts as given in my previous submission. These charts, however, supercede any similar charts that I have made in the past in that they are corrected and brought up to date, in accordance with the data tabulated in Table 6. The first chart is a well deliverability characteristic chart for Jumping Pound. The curve at the top of the chart shows the gas in place for various formation pressures. This chart reflects the formation calculated gas super-compressibility at the various pressures. The bottom of the chart shows the daily millions of cubic feet per well versus, on the right hand, the formation pressure, this curve which starts at zero and bends to the right shows the average open flow of the well for various formation pressures. For example, if the formation pressure is 3000 pounds, reading from the right-hand side of the chart, the average open flow of that is calculated at $18\frac{1}{2}$ million cubic feet per day. The rest of the chart, bending to the left, entitled "Average Delivery vs. Well-head Pressure" shows the calculated characteristics of the average well at Jumping Pound for various stages of reservoir depletion. Each of the curves is

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labelled with a number to indicate the formation pressure. The first curve is numbered 3964. It is the original bottom-hole pressure in pounds per square inch absolute. The calculated pressure that will be obtained at the well-head for various deliveries from this well can be read from that chart as of this time. For example, if the well is drawn at 10 million cubic feet per day the chart indicates, and the calculations indicate, that the well-head pressure available will be about 2500 pounds per square inch absolute. Now, as the formation pressure decreases in the reservoir the well-head pressure will also decrease. After the pressure has declined to 3000 pounds per square inch, with the same well delivering 10 million cubic feet per day, that well would have a well-head pressure of about 1400 pounds per square inch. Similarly the chart extends down to 400 pounds. The next chart following the one I have just described is entitled, "Average well open flow - Withdrawal Characteristics" of the average Jumping Pound well. This chart is plotted from the previous chart and is given mainly as a convenience in working out the deliverability schedules. This chart shows the open flow in millions of cubic feet per day that can be expected from the average Jumping Pound well after a certain quantity of dry gas has been withdrawn. This chart reflects the shrinkage factor as shown on Table 6 for going from pipe line gas to reservoir gas.

The following charts are similar charts, two charts for each field. One, Well Deliverability Characteristics and the other, Average Well Open Flow -



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Withdrawal Characteristics, for each of the gas or condensate fields.

Q Dr. Hetherington, on page 6 - I am sorry, have you finished? Just finish your statement.

A All right. To summarize the conclusions

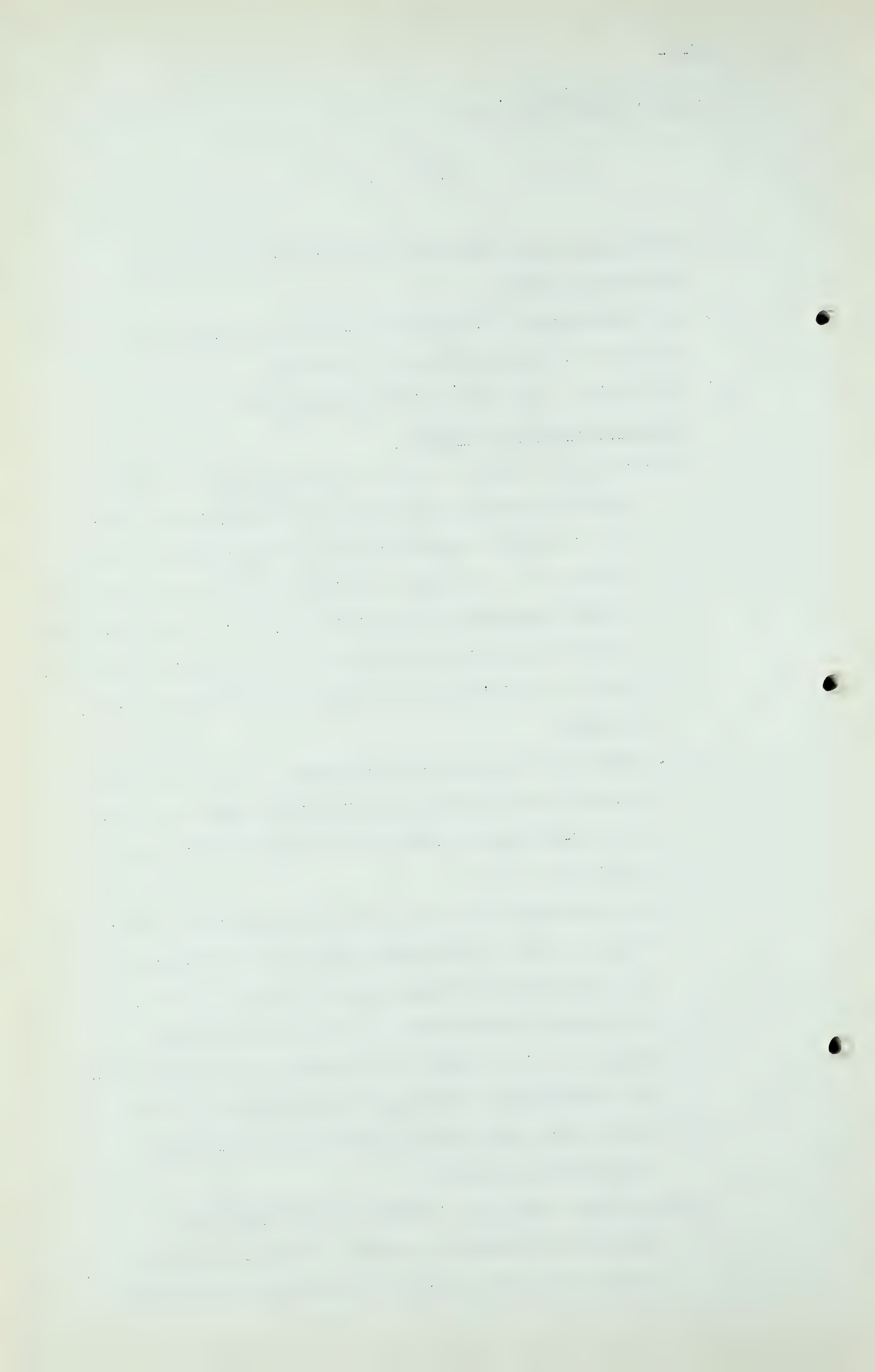
4. Summarized Conclusions

1. Proven gas reserves in the "Canadian Western Area" are sufficient to provide a deliverable supply to meet estimated Canadian Western requirements for 30 years or for 50 years. Similarly, proven gas reserves in the "Northwestern Utilities Area" are sufficient to provide a deliverable supply to meet estimated Northwestern Utilities requirements for 30 years or for 50 years.

2. A surplus of deliverable gas exists in the "Canadian Western and Northwestern Utilities Areas" in excess of 30-year and 50-year requirements of these two utilities.

It is estimated that an average of 85 million cubic feet per day (123 MMcf per day peak) is deliverable for 20 years from these areas in excess of 30-year Provincial requirements. It is estimated that a surplus of an average of 48 million cubic feet per day (70 MMcf per day peak) is deliverable for 20 years from these areas in excess of 50-year Provincial requirements.

3. Proven gas reserves in "Small Local Areas" are generally adequate to provide a long-term supply of gas for small local distributing companies and



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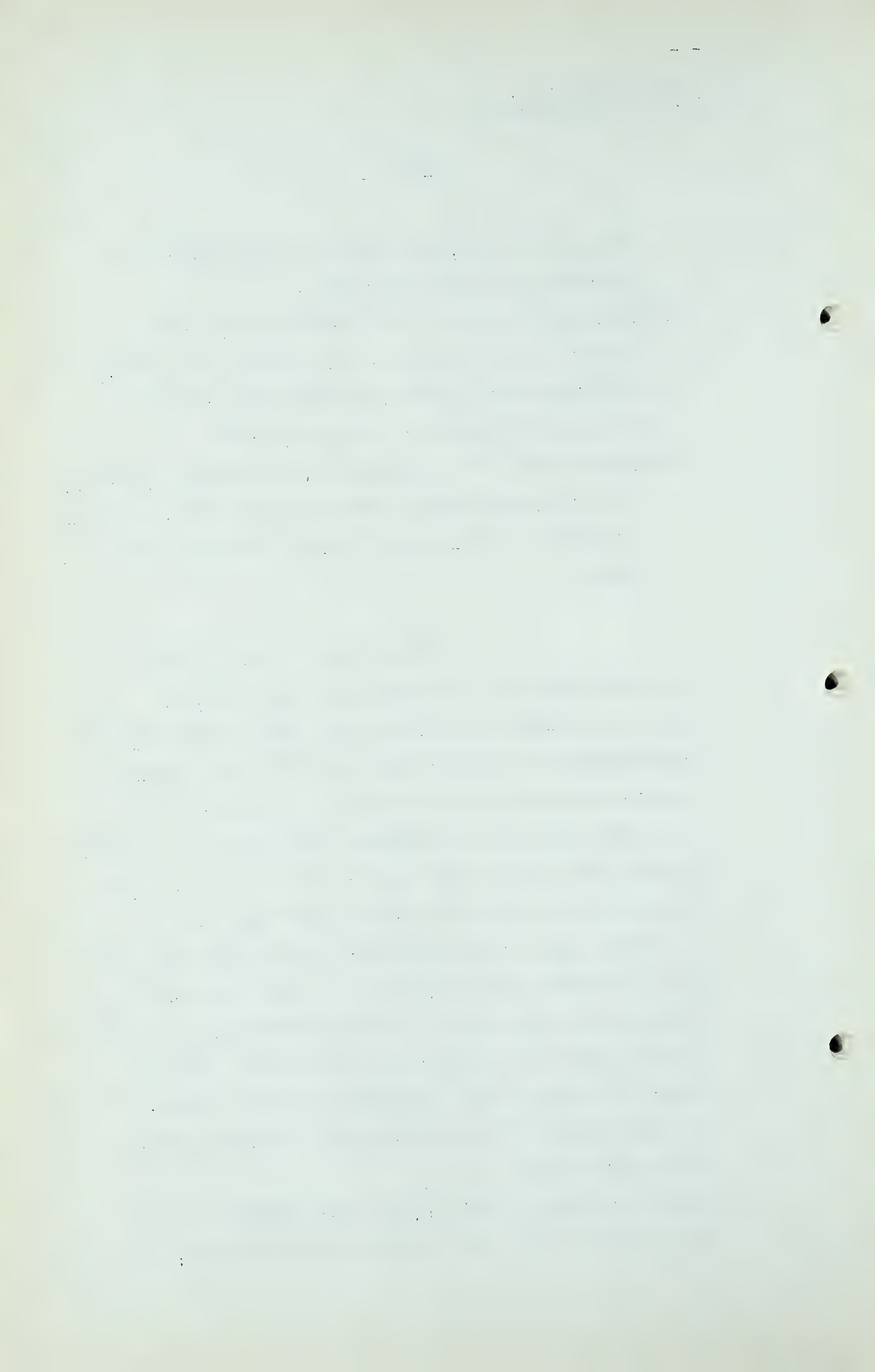
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for towns of 1,000 population or more which are presently not served with gas.

4. Proven gas reserves in the "Northern Area" are sufficient to provide a 30-year supply with 20-year deliverability to meet estimated requirements of Westcoast Transmission Company, Limited.
5. Attached Table No. 2 summarizes gas production schedules by fields and shows the amount of gas which is surplus in excess of 30-year and 50-year Provincial requirements.

This table on page 9 summarizes the large Table No. 2 and shows the amount of gas both on a 30-year and 50-year basis that Canadian Western and Northwestern Utilities and the small local systems require and that gives a measure of the surplus from all of the areas and the Westcoast requirements are shown for 20 years. Unallocated gas is shown at the reserves estimated by Dr. Nauss for those years and future deliverable gas is that gas which can be delivered from the fields after the 30 years in one case and after 50 years in the second case. The total marketable reserves are here shown as 1,284 billion cubic feet. That is about 300 billion cubic feet larger than Dr. Nauss's estimate because of my assumption of 1 trillion cubic feet in Whitelaw.

Q If you will turn to page 6, Dr. Hetherington. I just noted that you say there in the second paragraph:



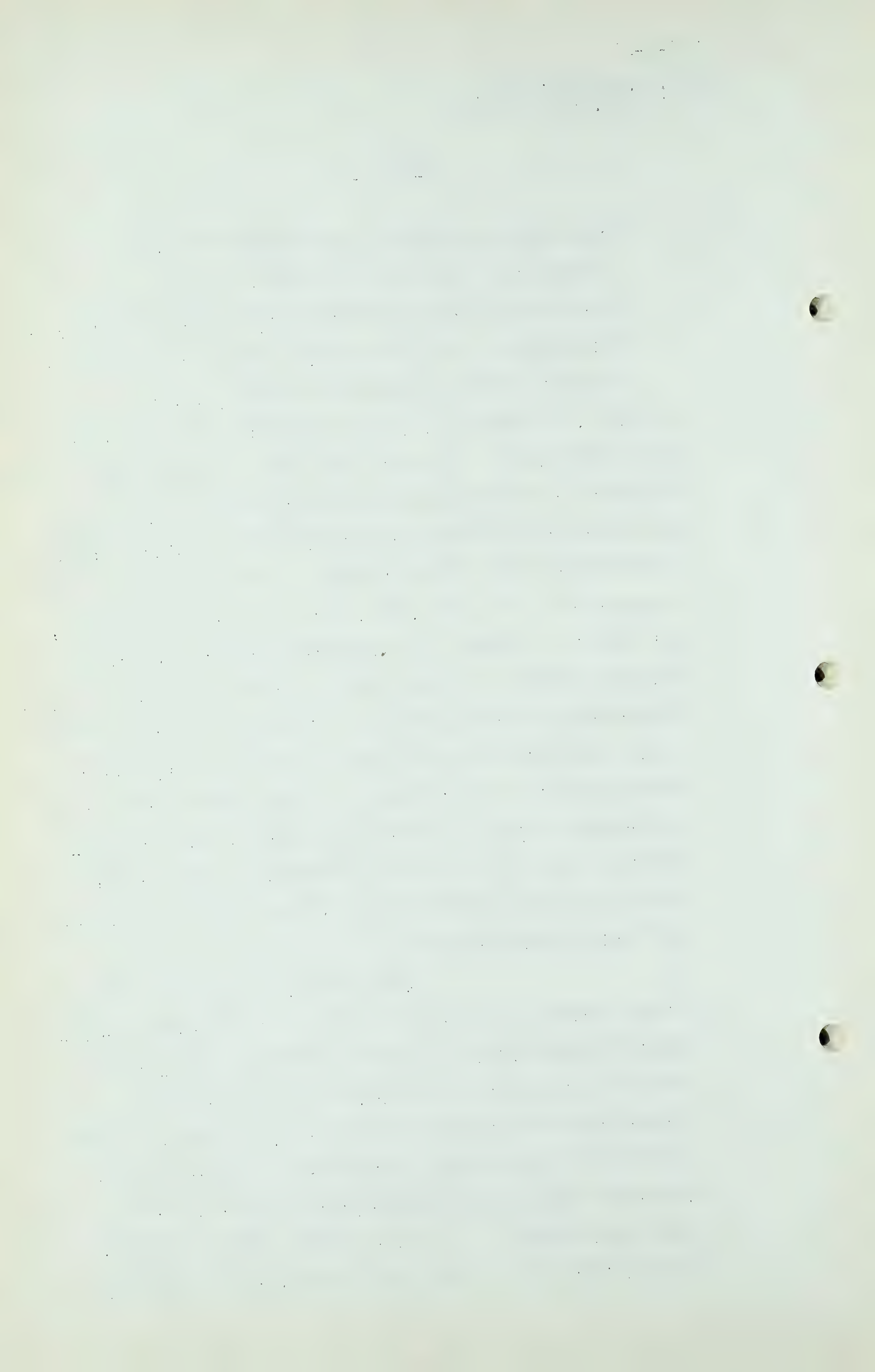
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"These yearly estimates of gas requirements and allocation of take and peak loads reflect a proposed allocation submitted by the Turner Valley Gas Company to the Conservation Board in respect of Canadian Western Natural Gas Company - - "

I think, Mr. Chairman, I should explain to the Board what that reference is. You will recollect during the summer the matter of connecting the Canadian Western system to the Jumping Pound field was discussed and acting on behalf of the Turner Valley Gas Committee, I attended on the Board in connection with that. Mr. Snider, of the Gas Company, did submit a forecast of the deliverabilities required by Canadian Western as between Jumping Pound and Turner Valley. In accordance with my practice, I forwarded copies of those to Dr. Hetherington and he has used them. I will obtain copies and file them in support of this application. I do not recollect just now whether they differ from the submissions made by Mr. Brownie in January or not. I think it will be useful for the Board to have them on its record and I will obtain copies and file them.

With regard, sir, to the matter of the demands or the requirements of the Westcoast Transmission Company Limited, I have distributed and will now ask to be filed with the Board, as an exhibit but not subject to an examination at this time, a "revised estimate of market for natural gas to be served by facilities of Westcoast Transmission Company Limited and its United States affiliates." It is the demand that is shown in this Exhibit that is taken into account in the deliver-



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ability requirements of the Westcoast Transmission Company.

DOCUMENT NOW MARKED EXHIBIT
J-32.

MR. C. E. SMITH: Do you want this marked in this hearing or are you just submitting it as one of those things.

MR. McDONALD: It can be marked or not as long as the Board has it and knows the basis of the deliverability requirements.

THE CHAIRMAN: I think it could be marked.

MR. McDONALD: But it is not subject for discussion at this hearing.

MR. C. E. SMITH: That is what I had in mind.

DR. GOVIER: Do you have an extra copy of Dr. Hetherington's exhibit J-31?

MR. McDONALD: Yes, sir. I have some more of these if the Board requires additional ones.

THE CHAIRMAN: I think we might recess.

(At this stage there was a short adjournment.)

(Go to page 810.)

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MR. McDONALD: If you would answer other
counsel, Dr. Hetherington.

CROSS-EXAMINATION BY MR. FENERTY:

Q Dr. Hetherington, I rather suspect that this report involved
a tremendous amount of work, is that right?

A Over a period of time, yes.

Q Yes, and my understanding is that in presenting this report
the Westcoast application is to be taken to export gas from
what I call the blue area. Is that the idea, Mr. McDonald?

MR. McDONALD: Yes.

Q MR. FENERTY: And am I right that in making
a change in the application and in doing all this work on
the basis of export gas from the blue area, that involves
a recognition that in your opinion that is the only way
you can satisfy both Government requirements, protection
of local consumption and export?

A Well, in my opinion, it is the best way.

Q What is that?

A Well, in my opinion, it is the best way.

Q Now, would you go a little further and say it is the only
way?

A I think you are probably right.

Q Well, I would not want to press you further than that.
Leave that for the moment. Now then, I gather from this
allocation that you have come to the conclusion that when
you are going to give protection for internal consumption
not only as to reserves but as to price, that the allo-
cation must be by areas rather than by so many cubic

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feet from each area brought to export and brought to internal consumption?

A That would be the logical way.

Q Otherwise you get into this surplus gas, which I take it is high-priced gas, it is the last part of the gas, the surplus gas?

A The more wells that are to be drilled to supply surplus gas would probably make the gas more expensive.

Q It is the high-priced gas, isn't it?

A Yes, it is.

Q The way to avoid those difficulties is to allocate by areas, which you have done, is that right?

A That is substantially correct.

Q Now, on this plan of yours at the moment I do not see conflict with some other figures.. I wanted to discuss Mr. Ralph Davis's figures with you for a moment because those are the ones he gave as outlining the requirements of the two utilities companies.

A Yes.

Q And it seems to me there is one place where your plan does conflict with his figures. The one place, I say, at the moment, I suspect that he had his eye on the Morinville field referring to the future requirements of the Northwestern Utilities.

MR. C.E. SMITH:

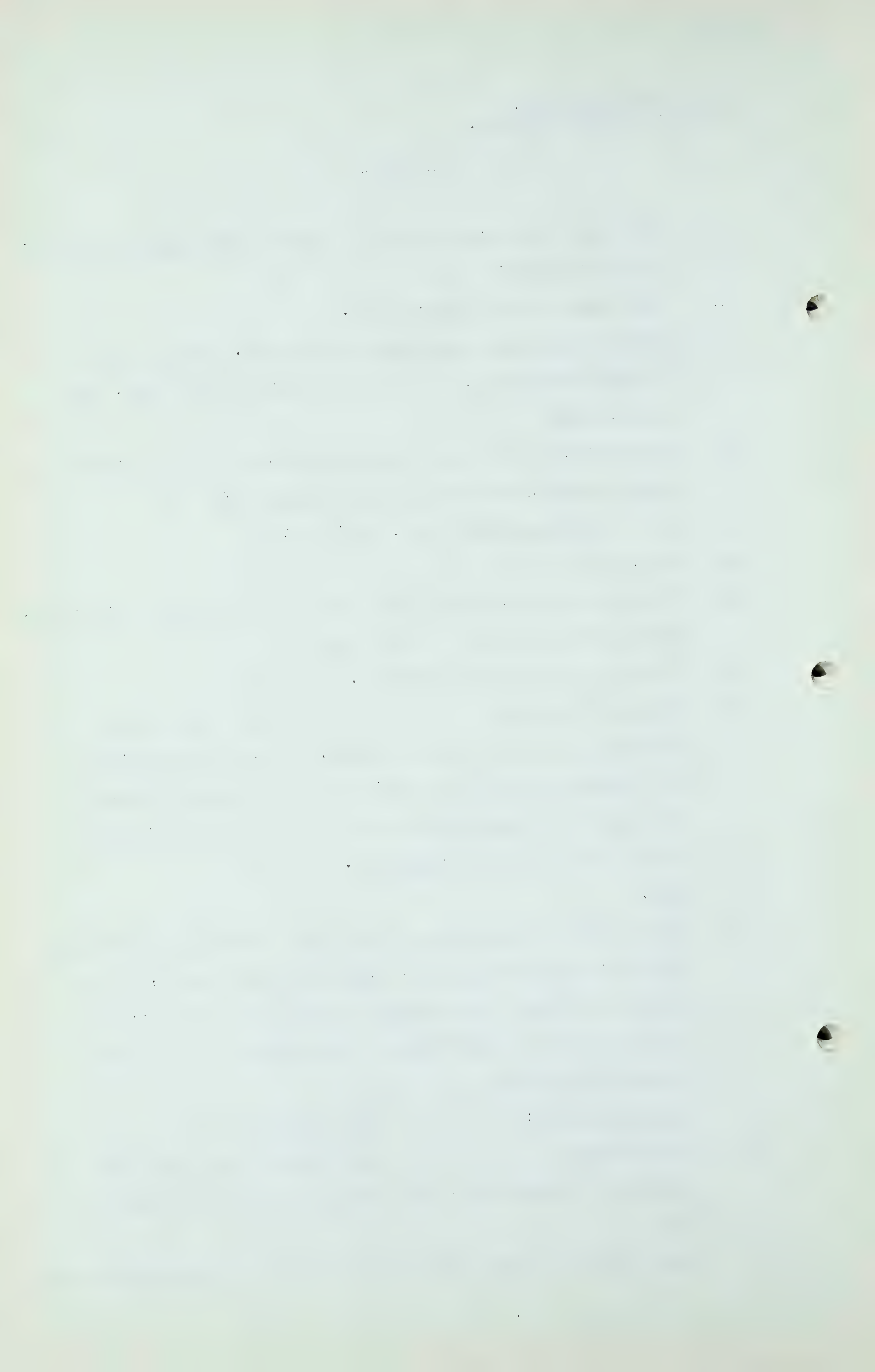
Eye on what?

Q MR. FENERTY:

Morinville, the only area tributary to Edmonton. You need Morinville for yours?

A Yes.

Q There might be some conflict there in his figures and yours?



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Cr. Ex. by Mr. Fenerty.
Exam. by Mr. D.P. McDonald.
Exam. by Dr. Govier.

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A Well, Morinville or the Excelsior-Picardville would be the closest additional gas should Northwestern Utilities need more gas.

Q Apart from that you do not tread on their toes?

A That is right.

Q Thank you.

MR. C.E. SMITH: As far as I am concerned,
Mr. Fenerty just read my mind here.

EXAMINATION BY MR. D.P. McDONALD:

Q There was just one thing I should put on the record here.
Dr. Hetherington, you may or may not know there is such an area as the Campbell area about 12 miles from Edmonton?

A Yes.

Q The Atcheson area about 7 miles from Edmonton?

A Yes.

Q Those new wells have not been considered in here?

A They have not been considered in here.

EXAMINATION BY DR. GOVIER:

Q Dr. Hetherington, in the preparation of this new submission have you given consideration to the economics of gathering gas from the various fields included in your deliverability schedule?

A Only qualitatively. By that I mean that I have considered the general size and proximity of a gas field to a supply and considered whether in my opinion it would be economical to connect the field into a pipe line or market system.

Q Have you made use of any rule-of-thumb or presumption in

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guiding you in that selection?

A Not any numerical rule. For example, I can point out one, originally we had Pouce Coupe with 122 billion cubic feet about 300 miles off the line that did not appear to warrant a spur line of that length to pick up that gas, and accordingly we put that in the unallocated classification, but now with Whitelaw and Normandville and the other developments in that area plus the encouragement given by our client as to the possibilities of additional gas up there, assuming Whitelaw combines with Pouce Coupe it does warrant apparently a spur line to pick that gas up.

Q You are of the opinion that all the fields allocated either to Edmonton, Calgary or what we refer to as the Westcoast area could be economically tied into a gathering system?

A Yes, in the Westcoast area, that is without exception, I think each of those fields can be tied in economically.

Q That also applies to the Northwestern Utilities or to the Calgary area?

A I have two reservations in the Northwestern Utilities area. I still think they can be tied in satisfactorily. One is at Stettler and the other is at Redwater. There have been opinions expressed from time to time that Redwater is marginal gas, it may be sour and require some sweetening. On the other hand, I keep referring back to East Texas where for a long time gas was flared there until the Railroad Commission clamped a ban and required that the flaring be stopped. Now, in the interests of conservation I believe it will be found that Redwater gas should be sent into a pipe line. There is enough of it and there is

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going to be enough of it to warrant a sweetening plant if that is necessary. In the case of Stettler I think that same thing applies, that Stettler is not very far distant from the Redwater terminus of the Northwestern Utilities' system and in the interests of conservation that gas should be used.

Q Did you have any reservations concerning Provost?

A The information that I have on Provost indicates that that field is worth picking up. In other words, wells are about the same as Viking wells, there is a large reserve there, and I know if that field were that far distant, let us say, from Tennessee Gas Transmission system in South Texas, they would pick it up.

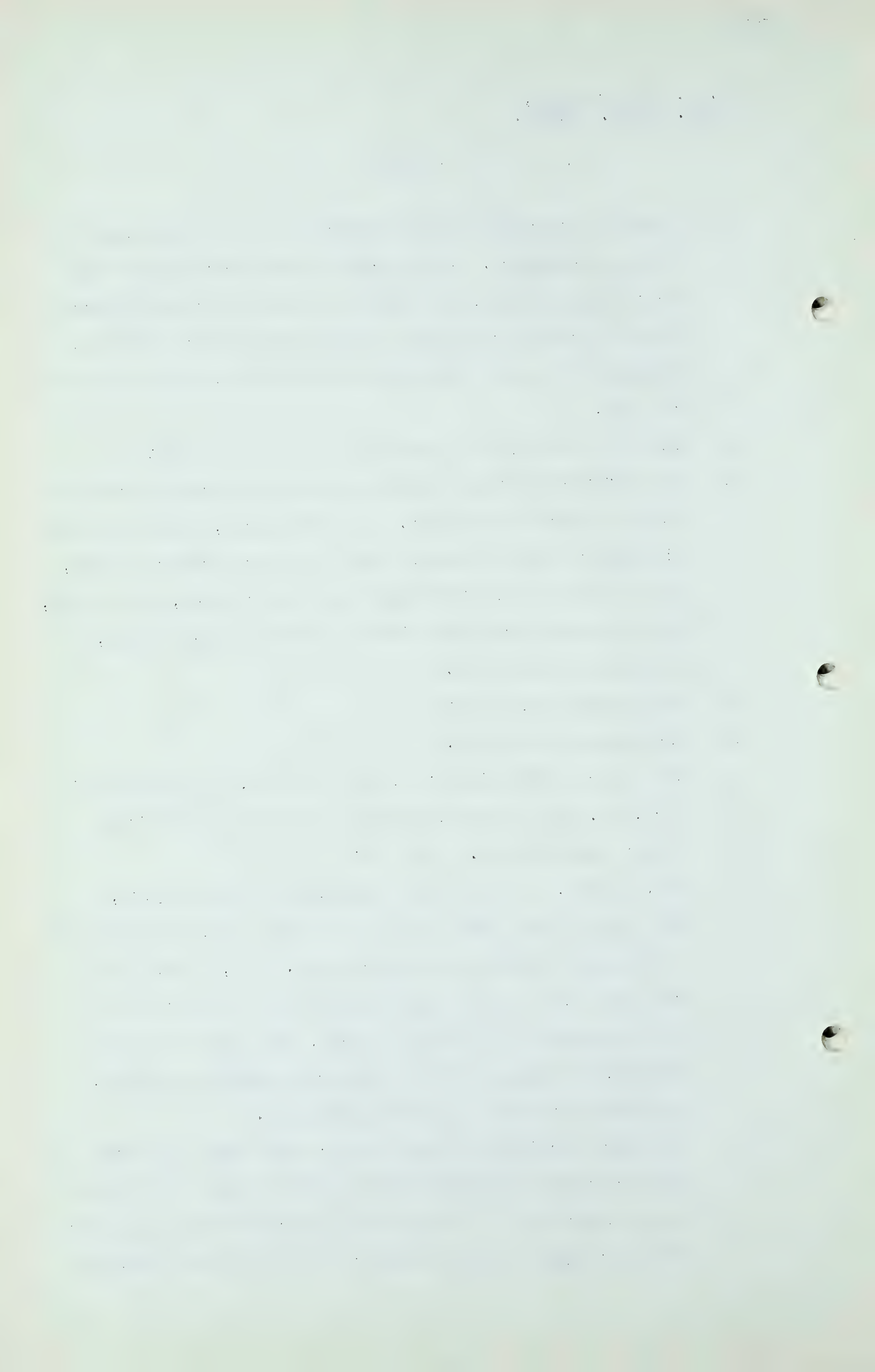
Q They would pick it up?

A They would pick it up.

Q What about Golden Spike? I was not sure, as a matter of fact, Dr. Hetherington, whether you included gas from Golden Spike itself. Have you?

A Yes, I have. I made this assumption at Golden Spike, that within five years the gas from that field is going to be processed through the Leduc plant. Now, I have no basis for that except the thought that the field is in the proximity of the Leduc plant, that that would be natural, to connect the two gathering systems together, at least as regards the casing head gas.

Q The Board received evidence two or three days ago from Mr. Mackenzie of Imperial Oil Limited to the effect that it now appeared to them that gas injection was called for in Golden Spike within a matter of one or three years in



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the interests of improving the recovery mechanism and the recovery of oil. The suggestion almost seemed to be that Golden Spike would require input gas from another source, that it has a negative potential in that sense. Would you care to comment on that?

A Well, only my assumption was in the other direction. To the extent any gas injection is required, why, my assumptions are in error and would cut into the surplus from those areas. There is only this other thing too, that following gas injection that gas is always there and will be available at some time in the future, possibly 20 years, and it might be that one of the other fields could be pulled a little harder during the first 20 years and the gas taken out of Golden Spike. I think in the overall thing gas from Golden Spike is going to be used.

Q It is merely a matter of whether or not that gas might be deferred for 10 or 15 or 20 years?

A That would be my thought, along that line.

Q Have you given consideration, Dr. Hetherington, to the economics of drilling the number of wells indicated in your schedule?

A There again no quantitative thought has been given to the economics of drilling except in the very expensive areas such as Pincher Creek and Jumping Pound. Now, in the case of Pincher Creek, we originally said there was 27 sections, we could have 27 wells. Now, with just some general figures as to the probable recovery from the wells I have come to the conclusion that probably 23 wells might be the most that would be drilled there unless the areal extent

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has been increased. Now, in the case of Viking-Kinsella my 30-years figures out around 170 wells, and I concluded that that was probably a reasonable number of wells to have in that field. In the 50-year schedule more wells than that are required and I will admit there is some question whether over 300 wells should be drilled.

Q Did I understand you correctly that your basis of a 30-year deliverable reserve for the Provincial requirements, you required 170 wells?

A 177 is the exact figure.

Q 177?

A And I believe in view of the areal extent of this field that that is a reasonable number of wells.

Q Did you hear the evidence of Mr. Davis on that subject, Dr. Hetherington?

A Yes, I did.

Q I do not imagine that he would take very much exception to your figure of 177 but I did get the impression that he might not agree with 570 odd.

A Well, I would agree with him on that later conclusion.

Q What, in your opinion, would be the reasonable maximum number of wells at Viking-Kinsella in the light of present knowledge?

A In view of the thin formation there and the fairly openness of the sand and the depth of the wells, it might be that two section spacing would be a reasonable maximum. Now, that is just an offering, it is not backed by figures, but I believe the probable one section spacing up there would be a little too close together for the nature of the

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production that can be obtained. On the other hand, one well every two sections would be about as far as wells could be spaced and still get complete drainage.

Q And as I understand your schedule, Dr. Hetherington, it in effect provides three safety factors. You are providing for what you call a 20-year surplus, and you do not make any special use of storage although that is a possibility?

A Yes.

Q And you assume always that the allowable will be held at 25% of absolute open flow, which in the declining years of a well might not necessarily be the case, is that true?

A Yes.

Q And that question of an allowable, Dr. Hetherington, I do not know whether you heard the discussion between Dr. Brokaw and myself, but I would like to ask you whether you have any views concerning a more reasonable method of setting the maximum allowable production than the present commonly used 25% of open flow?

A Well, I read Dr. Brokaw's ideas along that line and I think that is a very good idea if something can be worked out. Fundamentally, I think the possible damage to a well, whether it is sanding or watering up, is due to the pressure difference and I think he has a very good suggestion there, particularly during the later years of the life of a well. On the other hand, the system used in the Hugoton field whereby the potential of the well is determined at 80% of the back pressure is a convenient and equitable method of determining the allowable. There the allowable is determined as that gas which will flow when the well head pressure is

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80% of the shut in pressure. That does not mean each of the producers can produce that much gas. All of the allowables they have are thrown into a pool and each company makes nominations as to the amount of gas they want to take during the next month and the gas then is allocated in proportion to the open flow or to the allowable of each company.

Q But under conditions whether there were a market for all of the gas that could legally be produced, the allowable would be that figure?

A The allowable would be that figure. There is one thing to be taken into consideration there that would affect this deliverability schedule quite a bit. Here I have stuck to the strict theory that the well shall not exceed in any one 24-hour period 25% of the open flow. Now, that is not a limitation as such in the Hugoton field. The limitation is based on a monthly take.

Q So daily maximum might exceed that as well as daily average over the month?

A Yes. I have known of wells which produced their monthly allowable in three days and it did not seem to hurt them.

Q I do not think we would like to adopt that attitude?

A No. That is just a reference. Also, in the Panhandle field there are wells there that are producing outside of proration because of the formation they are able to produce at about 80% open flow every day of the year.

Q Would you agree with me that the method whereby the allowable is controlled by a certain percentage of the shut in well head pressure, that method in principle is equivalent

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to controlling at a certain percentage of absolute open flow if you include the hydrostatic head and the friction correction in the pipe, is that right?

A For a given sand. It will vary from sand to sand.

Q Yes. That is, the percentage of open flow might be 21 in one sand and 29 in another sand and so on?

A Yes.

Q But the two theoretically, friction and so on, are proportional to one another, are they not?

A Yes, they are.

Q In a practical case, Dr. Hetherington, would you say that the method in use in the Hugoton field does have the effect of permitting in the declining years of a well operation at a little greater percentage of the absolute open flow than it would permit during the earlier years of the well? What I am getting at is this, does the hydrostatic head and the friction correction operate in such a way that if you maintain the flowing wellhead pressure at a constant percentage of the wellhead pressure you are indirectly permitting an increasing percentage of that through open flow?

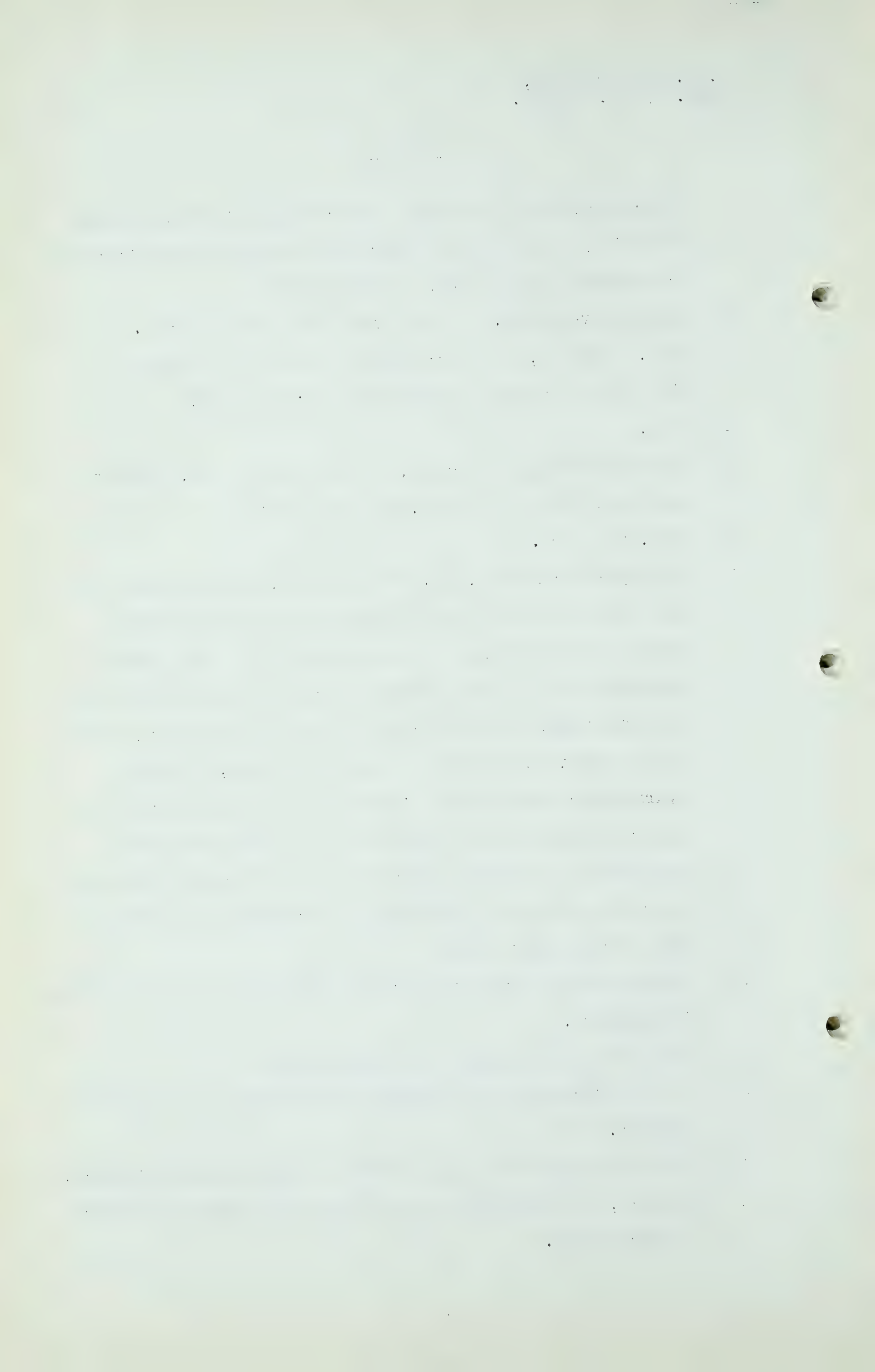
A In general the friction is a small amount of the total loss in pressure.

Q You would not say that of Pincher Creek?

A I had reference to the Hugoton field where the wells are shallow.

Q So in the Hugoton field it would not make much difference?

A In fact, the pressure drop in the tubing and casing there is very small.



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Q What about Pincher Creek?

A I understand that the production scheme there is going to be fairly complicated and may require circulating of hot oil and various other things that will use up a lot of space in the casing, so that if the well is produced at a percentage of the back pressure you will get a smaller, and considerably smaller, I would think, allowable during the initial years.

Q Would it follow that if the allowable during the initial years was so adjusted as to give 25% of absolute open flow but were actually regulated by saying that the flowing well head pressure had to be such-and-such percentage of the shut-in well head pressure, that during the declining years the allowable in terms of open flow would actually decrease if you maintained the same percentage on flowing to shut-in well head pressure? I am sorry that is so involved. Do you see what I am driving at?

A I see what you are driving at. I am just trying to think. I think the percentage would increase, but let me think about it just a second. If the percentage of back pressure were so adjusted that original 25% open flow could be obtained - -

Q Let us just assume that would mean 70%?

A All right, that would mean 70% back pressure, then at that time the casing drop would have a significant effect on that production. Later on as the production declined from the well the casing drop would have a less significant effect and a larger percentage of the back pressure would

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be across the sand face instead of the casing and in that case the later production would be at a higher percentage of the open flow than originally.

Q What I have been leading up to in all this is this question, I would like to know whether in your opinion some consideration might be given to the concept that Dr. Brokaw advanced particularly in the case of deep wells, if the Board should adopt the method being used in the Hugoton field instead of the 25% of absolute open flow provided that the percentage relationship between the flowing well head pressure and the shut-in well head pressure were so adjusted to permit early in the life of the field about the equivalent of a 25% absolute open flow.

A I would think that system would have quite a bit of merit in deep wells where the casing drop originally is a deterrent to the getting out of the gas and where it has little effect in the later life of the wells. That, I believe, would permit producing at 25% initial, later on measured at maybe 40% of the open flow in the later years.

Q Do you think that would in any way endanger the well or the recovery from the pool?

A Well, without a detailed study that question is a little hard to answer. On the other hand, I agree with the idea that Dr. Brokaw advanced, that it is the pressure drop across the sand face that counts. In storage fields where we are not concerned with Government regulation as to the amount of gas that can be produced, the pressure drop across the field plus the operators' feel of the well, if you want to call it that, are the only things we are

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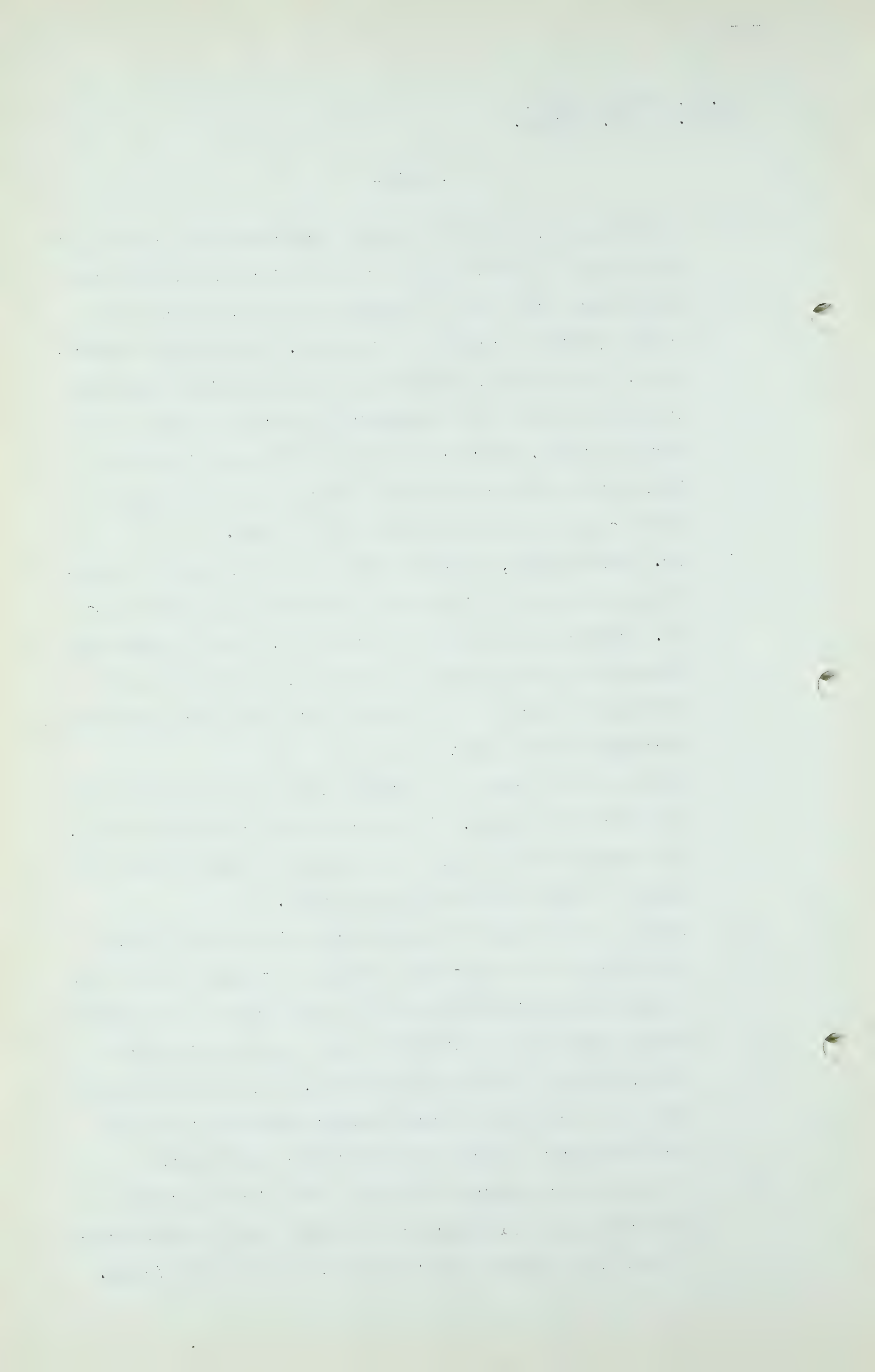
guided by. In storage fields we calculate the cooling of the gas as it flows across the sand face and do not take a pressure drop which is greater than that which would cause hydrate formation by freezing. That is one limitation. The second limitation is the feel of the operator running the well as to whether they are going to produce sand or water. Particularly in the storage fields of Michigan we produced them at a very high percentage of their open flow on a few days of the year.

Q Dr. Hetherington, assuming that some simple way to administer regulations of the type that would give effect to Dr. Brokaw's idea could be worked out, would you have any reservations whatsoever in seeing wells permitted to operate at approximately the constant sand face differential throughout their life?

A I think in the case of a dry gas field that there would be no objection to that. In the case of a condensate field, consideration would have to be given to what is going to happen to the fluids at the well bore.

Q Suppose in the case of a condensate field after giving consideration to those very things it was determined that a sand face differential of 150 pounds could be tolerated without any danger whatsoever early in the life of the field, that is just an illustration, do you think 10 years later that there will be any danger whatsoever if sand face pressures of that same order were permitted?

A I believe as a general statement that if that pressure differential is satisfactory initially that the same conditions will prevail later on in the life of the field.



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Q Do you know anywhere, Dr. Hetherington, where those concepts are involved in the regulations controlling the allowable production?

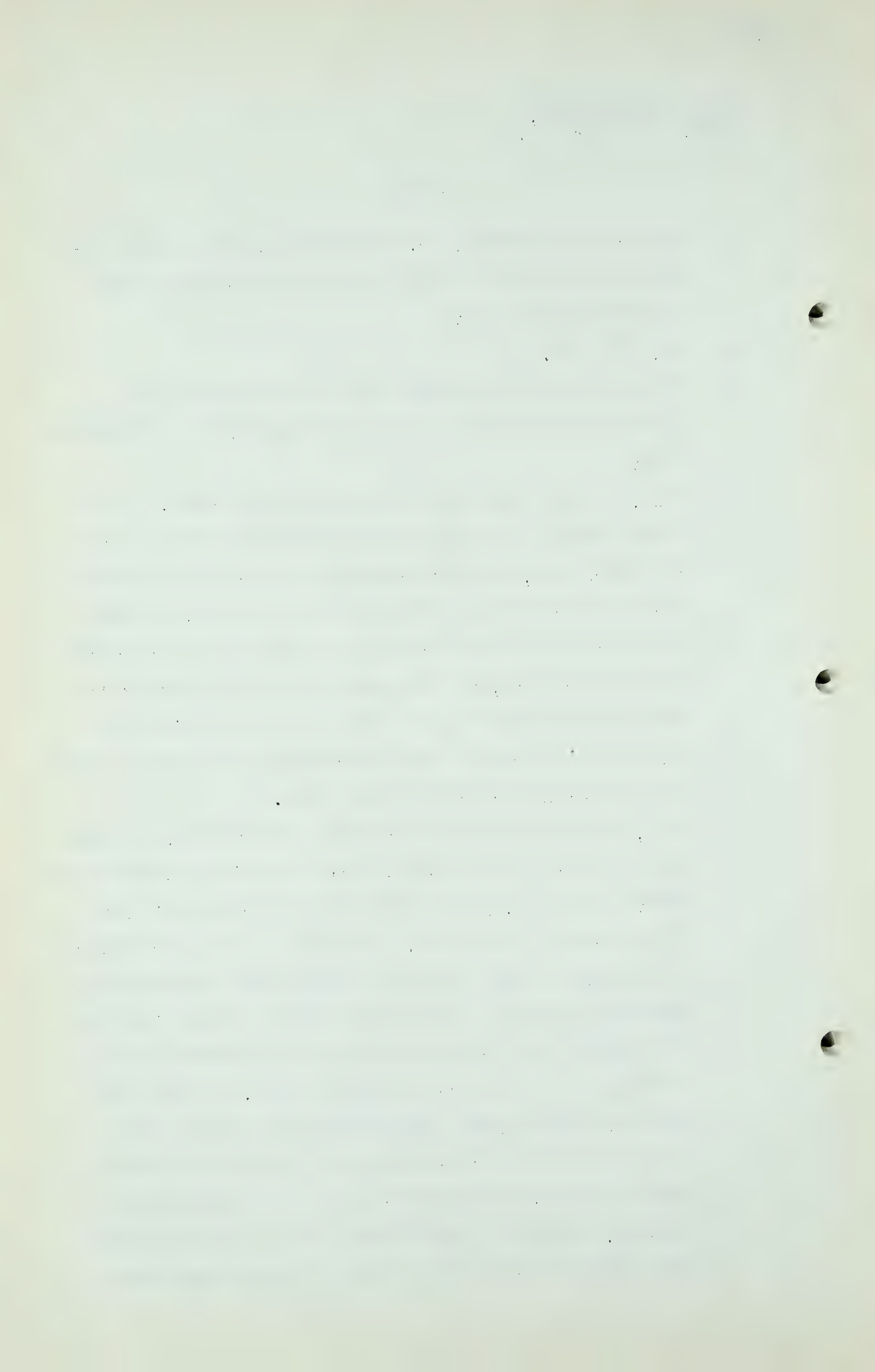
A No, I do not.

Q Have you any idea how they might be introduced in a practical regulation or in a practical way in a regulatory form?

A Well, I think that could be worked up all right. It is just a matter of studying the differential and as far as test data goes, the differential can be calculated from a back pressure test just the same as open flow, so that there are enough data from an open flow test to calculate this differential, no additional tests would have to be made and it would be just a matter of re-defining the allowable in terms of the differential instead of in terms of the so-called calculated open flow.

Q Well, how would you arrive at that differential, by taking the one which theory would indicate to exist at 25% of open flow? If you do, you go around in a circle, don't you?

A You go around in a circle. There is no basis particularly for the 25% of open flow and I think that a good bit of judgment is going to have to be used in setting just what the pressure difference permissible is going to be, and I think it will vary from field to field. In the case of Pincher Creek where the sediments are fairly well consolidated the differential can be kept a bit higher than at Viking-Kinsella where there is a possibility of sanding. I believe that in that sort of regulation that some judgment or a similar type of judgment will have to



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be employed in arriving at the differential that was
employed in arriving at this 25%.

(Go to page 825)

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Q Was it employed there, do you know?

A Some judgment of some kind was certainly employed.

Q I just have one other question dealing with specifically with your brief, Dr. Hetherington. On Table Number 6 you refer to the deliverability curve slope, and, although I think I know what you mean, I just want to make doubly sure. When you were making reference to the 1.15 figure, I recall you saying that you used that slope because it gave results which were more conservative than would have been the result if you had taken .85 or a unity slope. Now, as I understand that, you mean provided the absolute open flow point is fixed?

A That is right, provided the absolute open flow point is fixed, then a slope of 1.15 gives a lower allowable open flow in latter years than does the slope of .85.

Q I see. Now, suppose we just had some test data, just a number of points on the graph, and we do not know the absolute open flow, we were trying to get it from your graph, would you agree that under those circumstances the conservative approach would be to set a line having a slope less than one through the points and extend that one?

A Yes, that is right.

Q That is fine. I just wanted to make sure. Thanks very much.

THE CHAIRMAN: Thanks, Doctor.

MR. S. B. SMITH: I assume Mr. McDonald is finished, sir?

MR. McDONALD: Yes, I am sorry.

MR. S. B. SMITH: You are finished or not?

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MR. McDONALD: I am finished.

MR. S. B. SMITH: I will call Mr. Galloway.

.....

JOHN O. GALLOWAY, having been first duly sworn, examined by Mr. S. B. Smith, testified as follows:

MR. S. B. SMITH: Mr. Chairman, and Gentlemen, perhaps I should say first that we expected to have Mr. Jenkins here, who has prepared a brief, which, I believe, has already been filed with this Board and signed by Mr. Jenkins and Mr. Galloway. That is the study of natural gas deliverability. Mr. Jenkins, unfortunately, is presently engaged in computing reservoir data for the hearing before the Federal Power Commission and cannot be available here at the present time. However, Mr. Galloway has, I believe, discussed the matter in detail with Mr. Jenkins and I think he will be prepared to answer to the extent of his knowledge upon that subject.

Q Mr. Galloway, you are a geologist?

A Yes, I am.

Q And, briefly, what are your qualifications and your experience in that field?

A I am a graduate of the University of Oklahoma.....

THE CHAIRMAN: The Board has a pretty good knowledge of Mr. Galloway's qualifications.

MR. S. B. SMITH: Yes, sir. I do not believe, sir, Mr. Galloway's brief has been numbered, although it has been available for some time.

THE CHAIRMAN: Exhibit J-33.

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BRIEF ENTITLED "AN ANALYSIS OF THE
NATURAL GAS RESERVES IN THE PROVINCE
OF ALBERTA" PREPARED BY MR. J. O.
GALLOWAY MARKED EXHIBIT J-33.

Q MR. S. B. SMITH: Our practice here, sir, is not
to have the brief read in full, but to follow the practice
which was suggested some time ago of having particular
parts referred to and then making the witness available
for cross-examination.

A Yes, sir.

Q Mr. Galloway, would you turn first to Page 3 of your Memo-
randum or brief? Under the heading "General" you refer
to some 30 discoveries of natural gas which have been
made in wildcat wells largely restricted to East Central
Alberta, and you say that undoubtedly several of these
will eventually, with further drilling, develop into
major or, at least, large accumulations. Have you made
any calculations or included any gas reserves from those
areas?

A I have not.

Q What, in your opinion, are the potential possibilities
of those 30 areas to which you have referred?

A I think the over-all potential is very great.

Q There are a very considerable number of wells in those
areas, are there not?

A There are.

Q And where are these great potential, considerable poten-
tial possibilities that you refer to, in a general way?

THE CHAIRMAN: Mr. Smith, do you have an
extra copy of that? I have the wrong one here.

MR. S. B. SMITH: Yes, sir, I have.

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THE CHAIRMAN: Thank you.

Q MR. S. B. SMITH: Generally, where are these areas?

A The Morinville area north and northwest of Edmonton is one I have in mind. The area which lies north and north-east of Princess is another.

Q And do you look for major or large accumulations of natural gas as being possible or probable in those areas?

A That is correct. There are substantial flows of gas in a great many localities throughout that general area and, based on the principles which govern the accumulation of natural gas, with so many discoveries as has been indicated, some of those should be substantial.

Q Now, Mr.Galloway, would you turn to the Table, the tabulation following page 15 in your brief, and I observe in your tabulation under the heading "Leduc-Woodbend" you included only the gas cap?

A That is correct.

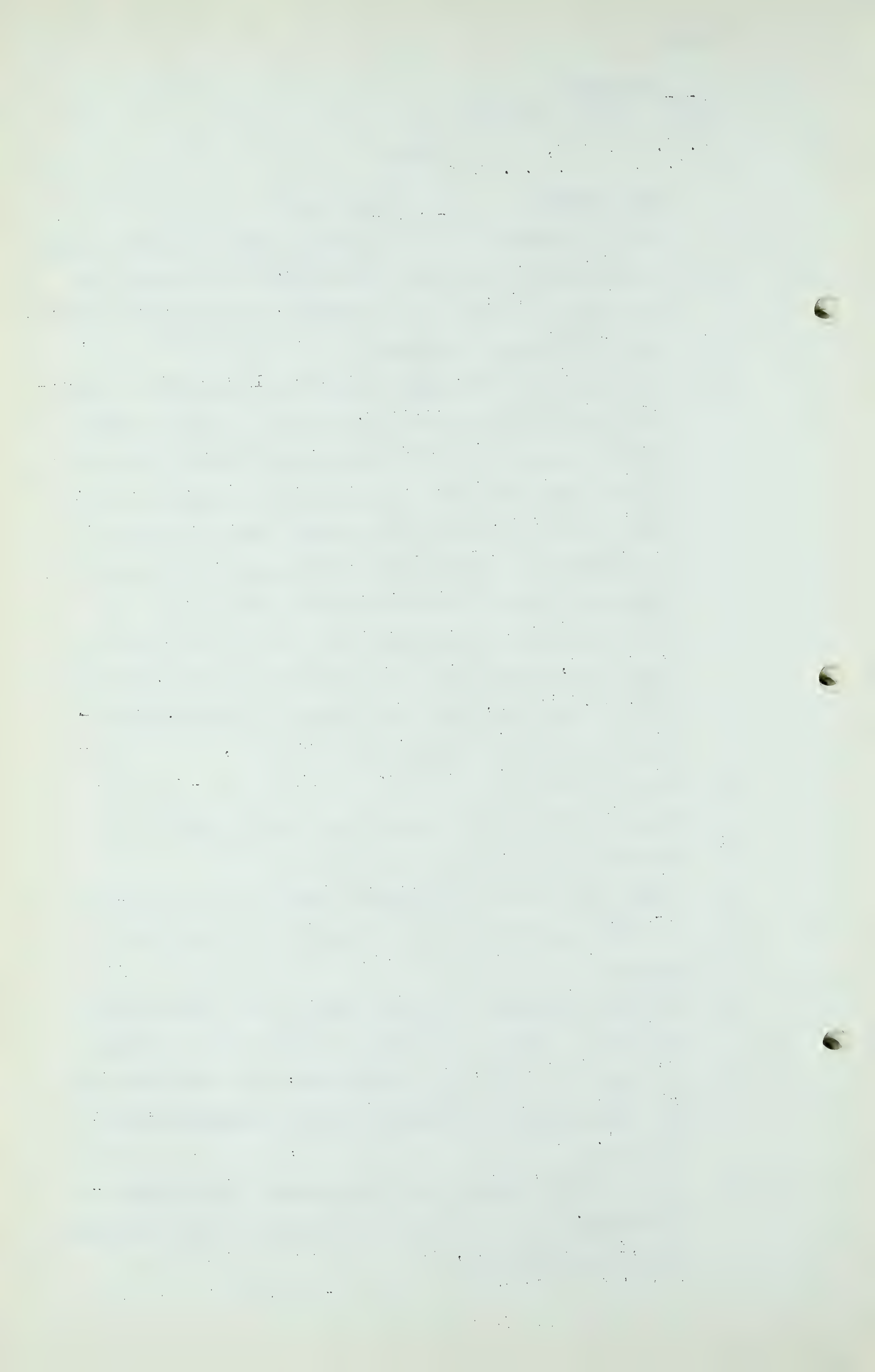
Q Would you discuss the subject of solution gas in the D-2 and the gas in the Cretaceous?

A There are so many imponderables present in an analysis of that type that I prefer to omit them from my own analysis.

Q Has the Cretaceous, in your opinion, been sufficiently drilled to enable the field to be delineated in Leduc?

A Not yet. It may have been drilled, but tests have not been made which would indicate to me a satisfactory delineation.

Q Well, in your opinion, can a measurable flow of gas be ascertained with respect to the D-2 and of the Cretaceous at the present time?



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A A measureable flow?

Q Yes, can you measure the amount of the marketable gas there, in your opinion?

A No, not at the present time without making assumptions which I prefer not to make, because I consider them more or less imponderable things.

Q And what you you to say about the solution gas in the D-3 at Leduc?

A I have not made any computation for that either.

Q For what reasons?

A For the same grounds.

Q Yes?

A Although I will agree that with production substantial amounts of natural gas will be produced.

Q And, particularly, what are the grounds there? That, of course, is tied up with oil production?

A That is right.

Q Yes?

A I do not believe I understood your question, Mr. Smith.

Q Just tell us briefly why you have not included in your tabulation of gas reserves the solution gas in the D-3?

A In making my analysis I was interested in determining the gas which I could make a sound opinion upon as to its present and future deliverability. If we, in this analysis, consider solution gas, you then must go into opinions as to the amount of production which will be produced. We arrive at an opinion as to the amount of gas in solution by computation of proved reserves, which can, in those very assumptions, we have to arrive at a recoverable factor for solution

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gas which may vary through wide limits. We must consider the economics of taking the solution gas to market if we are to consider it in this at the present time, so that with all of those imponderables I thought I might probably arrive at an analysis on a more sound basis by leaving those out of the analysis.

Q And is it a possibility, in your opinion, that some of that gas will be used for repressuring purposes?

A I have no doubt that a considerable portion of the gas that will be produced along with the crude will be used for repressuring purposes in one or more reservoirs, and there are, as yet, some imponderables so far as I am concerned, as to the type of reservoirs which exist in the Province, as far as crude oil production is concerned, and I do not believe that any decision can be made at this time as to what use will be made of the gas with particular reference to repressuring.

Q Mr. Galloway, will you turn to your map, which is the last sheet in your brief, and tell us what that map is?

A This is a map of the Province of Alberta on which I have...

Q Whose map is it? Did you prepare the map?

A Pardon me, this is a map which was prepared from a base which I obtained from the Petroleum & Natural Gas Conservation Board.

Q And what have you superimposed on that?

A I have superimposed on it in colour the location of certain, if not all, certainly nearly all of the wild-cat wells in the East Central area of Alberta.

Q Does this map show the delineation of the gas fields according to your computations?

2. Methodology

The first part of the study focuses on the theoretical framework and the research objectives. It discusses the importance of understanding the underlying mechanisms of the phenomenon being studied. The methodology section describes the data collection process, which involved a combination of qualitative and quantitative methods. The results section presents the findings of the study, highlighting the key trends and patterns observed. The discussion section interprets these findings in the context of existing literature and provides insights into the implications of the study. Finally, the conclusion summarizes the main points and suggests areas for future research.

The study was conducted over a period of six months, during which time a large amount of data was collected and analyzed. The results of the study are presented in a series of tables and figures, which provide a detailed overview of the data. The discussion section provides a thorough analysis of the results, highlighting the strengths and limitations of the study. The conclusion summarizes the main findings and provides a clear direction for future research.

The study has several strengths, including a large sample size and a rigorous methodology. However, there are also some limitations, such as the potential for bias in the data collection process. Despite these limitations, the study provides valuable insights into the phenomenon being studied and contributes to the existing body of knowledge in the field.

The study was funded by the National Science Foundation, which provided the necessary resources to conduct the research. The authors would like to thank the reviewers for their helpful comments and suggestions, which have improved the quality of the manuscript. Finally, the authors would like to thank their colleagues and friends for their support and encouragement throughout the study.

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A No.

Q It does not?

A The map which I obtained as a base had on it the oil fields and gas fields and the pipe line.

Q Now, I believe you have some larger originals of this map, have you not?

A I do.

Q Have you them here?

A They are rolled up against the wall.

Q They are just somewhat easier to read than the map. Do you wish to have those marked, Mr. Chairman?

THE CHAIRMAN: Are there many of them there?

MR. S. B. SMITH: There are quite a number, and we can distribute the map if anyone else wants a copy, sir.

THE CHAIRMAN: Probably you had better give them all one number, Exhibit J-34.

MR. S. B. SMITH: They are just the one map, duplicates of the same map.

THE CHAIRMAN: I see.

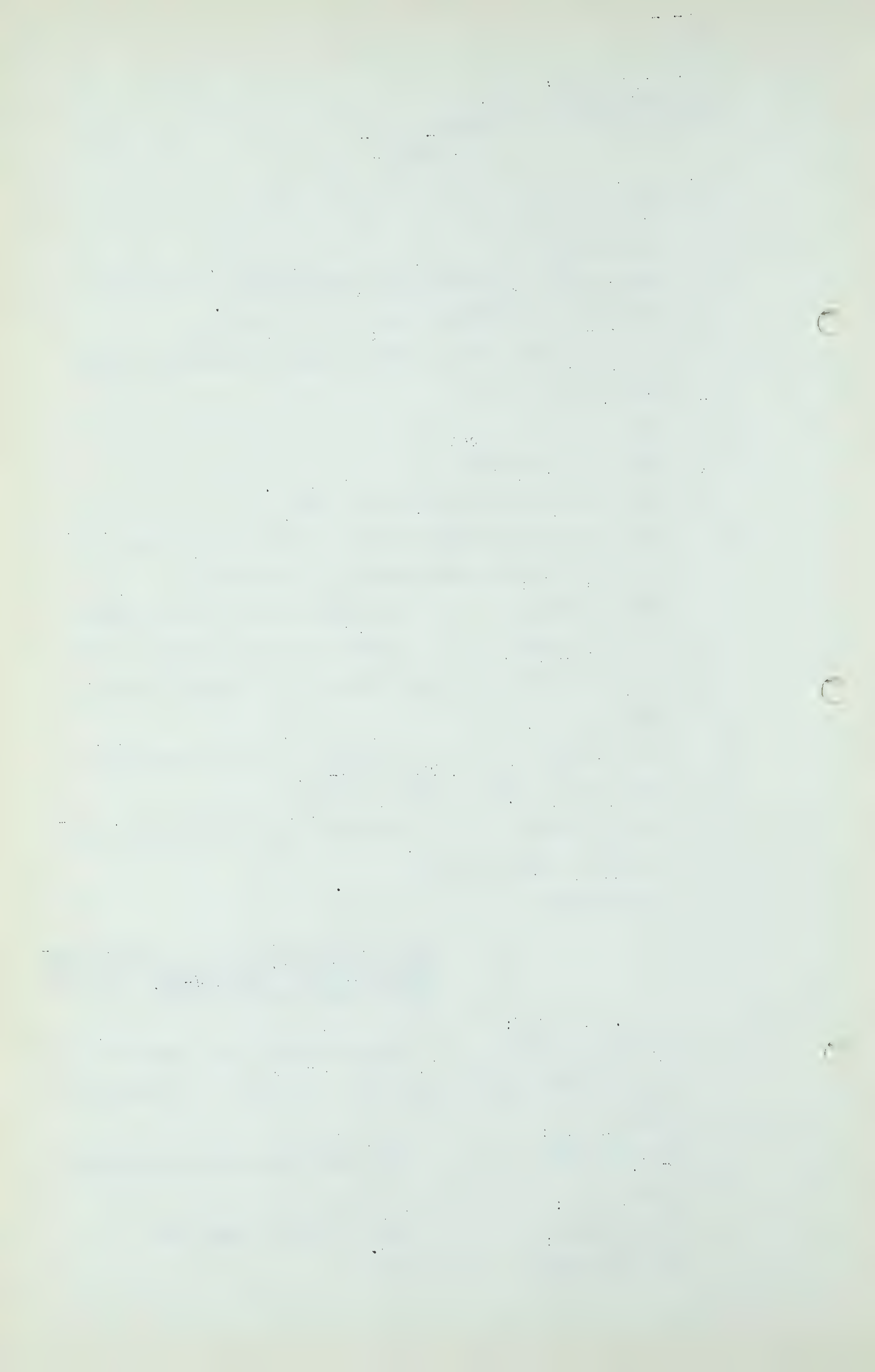
MAP OF THE PROVINCE OF ALBERTA SHOWING OIL FIELDS, GAS FIELDS AND PIPE LINES MARKED EXHIBIT J-34.

MR. C. E. SMITH: Does somebody want these except me? They were put on my desk. Are they to be marked or what?

THE CHAIRMAN: Yes, they are marked as Exhibit J-34.

THE WITNESS: May I take the map out?

THE CHAIRMAN: Yes.



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- Q MR. S. B. SMITH: Now, Mr. Galloway, I would like you to turn to Page 9 of your.....
- MR. C. E. SMITH: Was the large map given a number?
- THE CHAIRMAN: Exhibit 34.
- MR. C. E. SMITH: J-34?
- THE CHAIRMAN: Yes.
- Q MR. S. B. SMITH: How many of those have you?
- A I have two here.
- MR. S. B. SMITH: Is one sufficient for the Board?
- THE CHAIRMAN: We can use this one.
- MR. S. B. SMITH: It is the map which is included in the back of the brief, Mr. Chairman, but that map is so hard to read, it is so small.
- Q The map in the brief is a photostatic copy of the map which has been marked, Mr. Galloway?
- A That is correct.
- Q I would like you to turn to Page 9 of the brief, Mr. Galloway, and I want to discuss with you the Pincher Creek area. You have arrived there at a total figure for marketable gas of 1700 billion cubic feet?
- A That is correct.
- Q I would like you to discuss and inform the Board the basic reasons which you had for arriving at your acreage of 11,680 acres?
- A I had made available to me the data of the Canadian Gulf Oil Company, and I studied the seismic maps which had been made from the seismic data obtained in the area, and after a study of it I was convinced that there should be eliminated at each end of the structure or

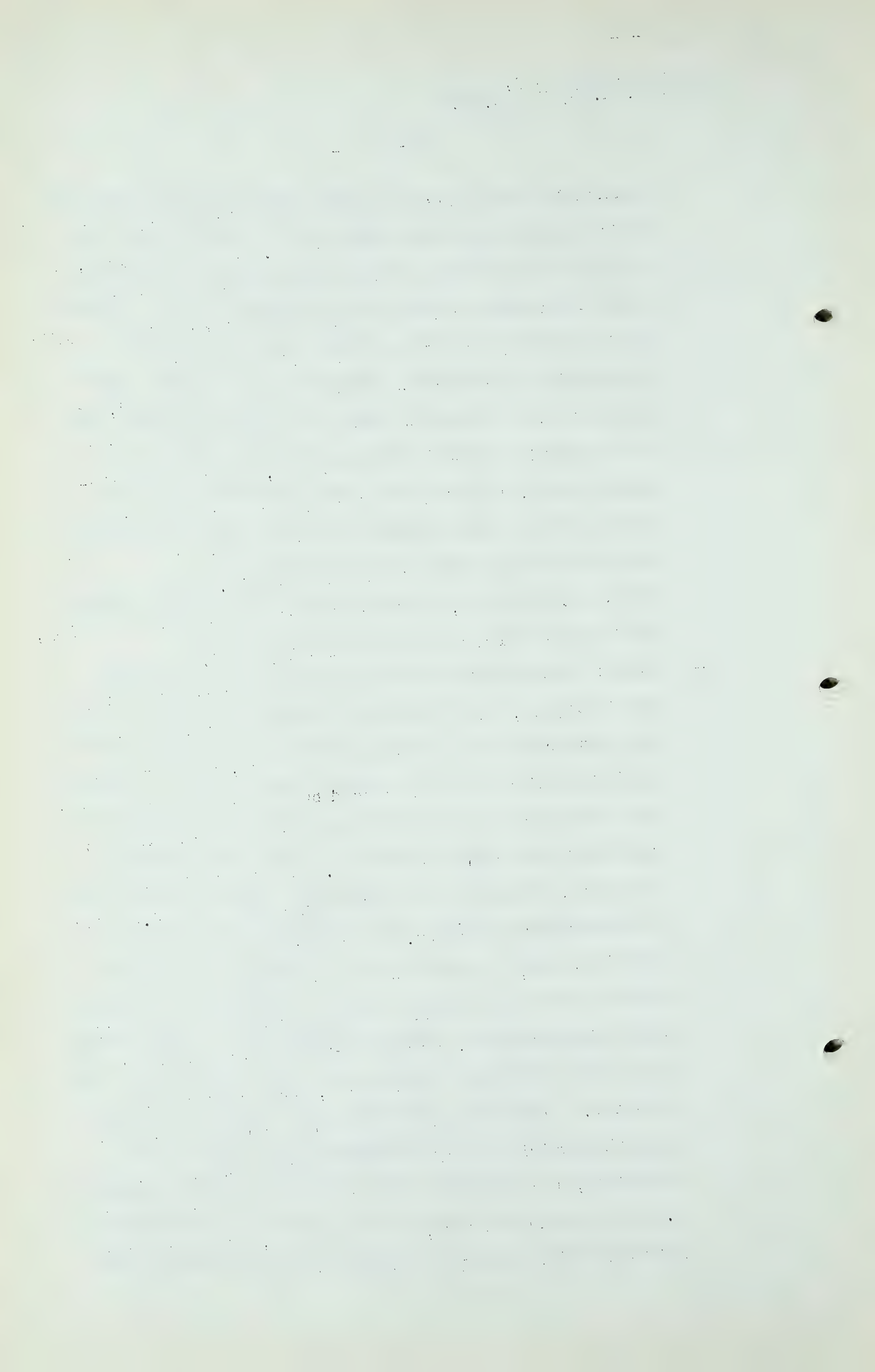
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anomaly that portion of the area which showed a variation from the general central portion. In other words, at each end of the anomaly there was a change in character of the data which, based on my experience with a similar type of geophysical data, I feel that it indicates something of a different character has occurred, and I can think of a number of types of changes in structure which could be present there, and, under those circumstances, I believe that those or certain portions of the ends of that anomaly should be omitted in considering proven acreage on the anomaly.

Q Now, Mr. Galloway, dealing with the subject of porosity, how did you arrive at your porosity of 4.3%?

A Again I had available to me the data of the Canadian Gulf Company, and I also had an opportunity to discuss the matter with one of their engineers, and I was not satisfied with the method used by that company in arriving at an opinion as to the porosity figure which could be applied to the whole reservoir. In an examination of the data I arrived at an arithmetic figure of 4.3% for the laboratory porosity, the laboratory measurement of porosity, and, in view of the production data later obtained from the wells, and the actions of the wells when being produced, I was convinced that there should be in the area considerably more, some considerably more porosity. Perhaps I should say some porosity greater than that which the Gulf engineers had taken, and, therefore, I considered the laboratory measurement of 4.3 as being indicative, in my opinion, of the bigger porosity which should be applied to the reservoir as



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Dir.Ex. by Mr. S. B. Smith

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a whole. It is much lower than, certainly, Turner Valley, and in view of the general picture obtained there by the Gulf Company in its production tests, and in its, even in its analysis of the data, which they obtained in the core, I considered the 4.3% porosity as being a reasonable figure.

I would like to say here that I was influenced to a considerable degree by the fact that the wells themselves do not perform in line with the conception of the Gulf engineers. There is another factor which enters into it, and that is that while the Gulf Company was very efficient in coring, still their cores averaged about 95% recovery, so that 5% of the core material is absent, 5% of the core section. If we took the average of the section in two wells, which would be 540 feet, 5% of that is 27 feet. 27 feet is missing.

Q What does that indicate to you?

A That indicates to me that there is some other portion of the section which is producing or will be when those wells are placed on production. If we compare that fact to the Gulf engineers' data, if we took 2.7%....

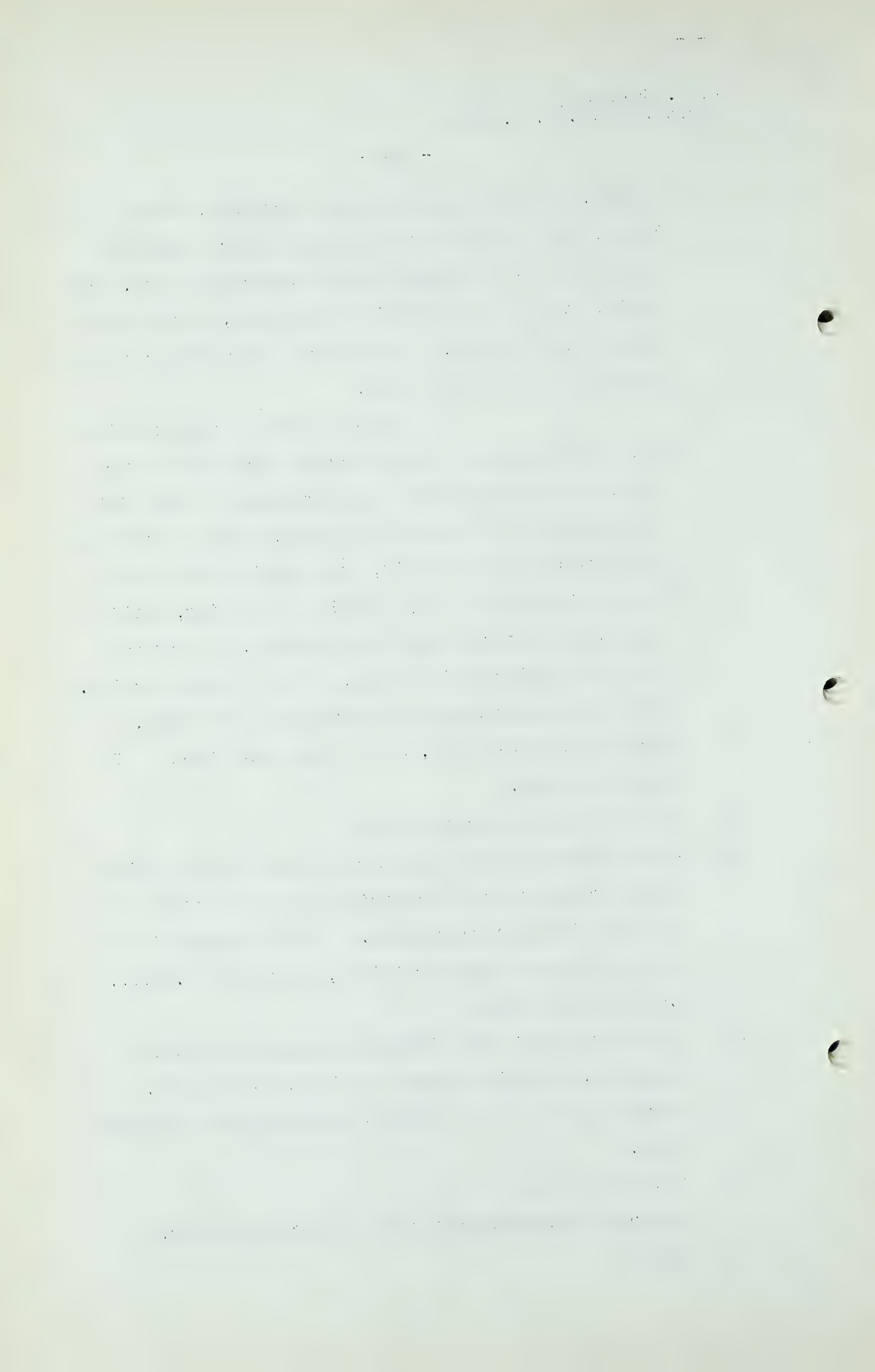
Q 2.6 I think it was?

A If we take 5% of the thickness assumed by the Gulf engineers, I think we come out with 10 or 11 feet. There was 27 feet of section unaccounted for in those wells.

Q 27 feet of core?

A 27 feet of stratigraphic section unaccounted for.

Q Yes?



J. O. Galloway,
Dir. Ex. by Mr. S. B. Smith

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A Something is contributing to the production of the well. That something the Gulf engineers think to be fractures. In my opinion it is more likely to be uncored, unrecoverable, unmeasured porosity.

Q Do you want to add anything else on the subject of porosity, Mr. Galloway? Or does that cover what you want to say?

A No, I think that covers it.

Q Now, will you turn to the subject of thickness? What have you to say about the thickness?

A The matter of arriving at an opinion in regard to the thickness is not an easy one. Certain assumptions must be made. We know that in one of the wells they had almost 600 feet of section, and in another well they had a little more than 500 feet of section. I have reason to believe from my experience in drilling of wells on the plains of Alberta, in those locations where the Madison limestone is present, the limestone may vary considerably in thickness. So faced with that point of view, I took the average of these two wells and considered the figure of 540 feet as being applicable to the whole anomaly. I took that as being applicable to the whole anomaly after I had eliminated from each end any feathering out which perhaps might be present and which would affect my own estimate, or which would affect me in making an estimate as to the recoverable reserves of gas.

Q In other words, I take it, having eliminated a large portion of the acreage at each end of the field, where you referred to it as possibly feathering out, when

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you come to your average, your average is higher because you have eliminated these areas where there is less thickness. Does that describe briefly your reasoning, Mr. Galloway?

A Not quite. When I speak of the feathering out, I was thinking of the contact of the top of the Madison limestone with respect to the gas/water contact. There is some thickness of Madison limestone present at Pincher Creek. Based on the information which we have, it is of a substantial thickness, and I think if I reduce the acreage at each end in those areas where I have reason to believe that there is a change in character, I might be able to arrive at a more accurate figure, but if I take the average of the two wells and apply it to the whole reduced anomaly, I would not arrive at such an accurate figure.

Q Now, Mr. Galloway, you have, I believe, discussed with Mr. Jenkins the presentation which he was to have made, and have you it before you?

A Yes.

MR. S. B. SMITH: I think, .sir, .that has been handed in but not marked.

THE CHAIRMAN: J-35.

MR. S. B. SMITH: Exhibit J-35.

BRIEF CONTAINING STUDY OF NATURAL
GAS DELIVERABILITY PRESENTED BY
PRAIRIE COMPANIES MARKED EXHIBIT
J-35.

Q Mr. Galloway, I am not going to ask you to read this brief. You have considered this brief?

— — — — —

• • • • •

1. *Chlorophyll a* and *Chlorophyll b* were determined by the method of Arar and Collins (1971) using a Shimadzu 1010 spectrophotometer.

4

7

9

100

:

100

J. O. Galloway,
Dir.Ex. by Mr. S.B.Smith

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A Yes, I have.

Q And you have discussed it in detail, I understand, with Mr. Jenkins of the Fish Engineering Corporation of Houston, Texas?

A I have, by telephone, Mr. Smith.

Q You have by telephone.

A Yes.

Q And are you in agreement with the conclusions at which he arrives?

A Yes, sir. I would like to point out that on Page 2 there is an error which should be corrected.

Q That is a typographical error?

A Yes, that is a typographical error.

Q That is in Paragraph 3, is it?

A I believe it is in Manyberries.

Q Yes.

A In line 4 the words "per day", I believe, should be in line 5, so that line 5 should have read "5.5 million cubic feet per day".

Q Oh, yes?

A I did not discuss this with Mr. Jenkins, but I believe that the change is obvious.

MR. C. E. SMITH: Let us have that again, will you please?

Q MR. S. B. SMITH: In line 4 under the heading, "Discussion and Conclusions", if you will drop down to "Manyberries", the words "per day" at the beginning of line 4 should appear after "5.5 million cubic feet" in line 5, so that then will read "is 5.5 million cubic feet per day." That is what you mean, Mr. Galloway?

1. The first part of the document is a letter from the President of the United States to the Congress, dated January 1, 1861.

2. The second part is a report from the Secretary of the Treasury, dated January 1, 1861.

3. The third part is a report from the Secretary of the Interior, dated January 1, 1861.

4. The fourth part is a report from the Secretary of the Navy, dated January 1, 1861.

5. The fifth part is a report from the Secretary of the War, dated January 1, 1861.

6. The sixth part is a report from the Secretary of the State, dated January 1, 1861.

7. The seventh part is a report from the Secretary of the Army, dated January 1, 1861.

8. The eighth part is a report from the Secretary of the Navy, dated January 1, 1861.

9. The ninth part is a report from the Secretary of the War, dated January 1, 1861.

10. The tenth part is a report from the Secretary of the State, dated January 1, 1861.

11. The eleventh part is a report from the Secretary of the Army, dated January 1, 1861.

12. The twelfth part is a report from the Secretary of the Navy, dated January 1, 1861.

13. The thirteenth part is a report from the Secretary of the War, dated January 1, 1861.

14. The fourteenth part is a report from the Secretary of the State, dated January 1, 1861.

15. The fifteenth part is a report from the Secretary of the Army, dated January 1, 1861.

16. The sixteenth part is a report from the Secretary of the Navy, dated January 1, 1861.

17. The seventeenth part is a report from the Secretary of the War, dated January 1, 1861.

18. The eighteenth part is a report from the Secretary of the State, dated January 1, 1861.

19. The nineteenth part is a report from the Secretary of the Army, dated January 1, 1861.

20. The twentieth part is a report from the Secretary of the Navy, dated January 1, 1861.

21. The twenty-first part is a report from the Secretary of the War, dated January 1, 1861.

22. The twenty-second part is a report from the Secretary of the State, dated January 1, 1861.

23. The twenty-third part is a report from the Secretary of the Army, dated January 1, 1861.

24. The twenty-fourth part is a report from the Secretary of the Navy, dated January 1, 1861.

25. The twenty-fifth part is a report from the Secretary of the War, dated January 1, 1861.

26. The twenty-sixth part is a report from the Secretary of the State, dated January 1, 1861.

27. The twenty-seventh part is a report from the Secretary of the Army, dated January 1, 1861.

28. The twenty-eighth part is a report from the Secretary of the Navy, dated January 1, 1861.

29. The twenty-ninth part is a report from the Secretary of the War, dated January 1, 1861.

J. O. Galloway,
Dir. Ex. by Mr. S. B. Smith
Cr. Ex. by Mr. Fenerty

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A That is right. That is correct.

Q Will you answer my friends, Mr. Galloway?

Q THE CHAIRMAN: Do you want to highlight anything else in this, Mr. Galloway?

A No, sir, I do not.

.....

CROSS-EXAMINATION BY MR. FENERTY:

Q Mr. Galloway, just on this question of Pincher Creek reserves, Page 9, I think you dealt with practically all the points I intended to ask you. In connection with that thickness, I believe, Dr. Hume gives 500 feet, and you give a figure of 540. Now, you are still satisfied with your figure of 11,680 acres? You remember his was quite a larger area, and he was just giving it as his opinion?

A My opinion is expressed here.

Q Now, I meant that Gulf has quite a larger area?

A My opinion is expressed here.

Q If you put or apply the Gulf figures given yesterday of porosity to your acreage, and we use Dr. Hume's thickness, you would have about 50% of what you have estimated here, wouldn't you?

A I would have a computation in arithmetic, Mr. Fenerty, and that is all, but not an expression of opinion.

A But you have a reason for not doing it, that is the result of what you say?

A I think you could compute it, anyone could compute it.

Q What is that?

Dear Sir,

I have the honor to acknowledge the receipt of your letter of the 10th inst.

and in reply to inform you that the same has been forwarded to the proper authorities.

I am, Sir, very respectfully, your obedient servant,

J. H. [Signature]

Enclosed find the same as requested.

Very respectfully,
J. H. [Signature]

Yours faithfully,
J. H. [Signature]

I have the honor to acknowledge the receipt of your letter of the 10th inst.

and in reply to inform you that the same has been forwarded to the proper authorities.

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Enclosed find the same as requested.

Very respectfully,
J. H. [Signature]

Yours faithfully,
J. H. [Signature]

J. O. Galloway,
Cr. Ex. by Mr. Fenerty

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A Anyone could compute that if they took a pencil and apply it.

Q Well, put it this way, it would not be over 60%? I am just trying to get a rough figure, if you cut your porosity in half, and see what you would get.

MR. C. E. SMITH: Take the other fellows, what they took in their porosity, and subtract it from 1700.

Q MR. FENERTY: I am not an engineer, and I thought that maybe Mr. Galloway would help me out. It would be say 60 or 70%.

A I can compute it for the Board, if the Board wishes me to do so.

Q You have no idea whether it would be 90% or 25? If you have not, I will let it go.

A I can do it for you, if you give me time to do so.

Q All right, I think the Board can also calculate it. I just wanted to get some idea as to the effect of that reduction in porosity, what it would be. Let it go.

(Go to Page 84C)

J. O. Galloway,
Cross-Ex. by Mr. Martland.

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MR. C. E. SMITH: If nobody else has anything to ask I have a few questions. Oh, I am sorry.

CROSS-EXAMINATION BY MR. MARTLAND:

Q Mr. Galloway, were you retained as geologist by Prairie Pipe Lines in April of this year?

A I believe it was in January.

Q So that you had already been retained when the application of Prairie Pipe Lines Limited was filed on April 11th of this year?

A Oh, yes.

Q And that was an application, you recall, to remove a maximum of 225 million cubic feet of natural gas per day for 30 years?

A I do not recall. I am not familiar with it.

Q The application contains a statement to the effect that the applicant believes from information presently available that there is a surplus of natural gas over the present and future needs of the people of the Province of Alberta sufficient to permit the granting of a permit for the removal of natural gas required by the applicant. Did you know that?

A No, I did not know that.

Q But you were the geologist at the time that statement was made?

A Yes. Now I would like to make a statement in regard to that if I may. I was retained by Prairie Pipe Lines in January and thereafter at occasional times I informed Prairie that I did not know what figure I was going to get

J. O. Galloway,
Cr. Ex. by Mr. Martland.

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when I produced the reserve needs of the Province. I thought they should be warned because I might not get the figure they wanted to have and they did not request me to prepare an appraisal until possibly July. I think that tabulation which I have in here following page 15 was presented to them in either late July or early August and with only a slight change to this tabulation which I submitted today. So that I was not aware of any statement they made of that type in regard to reserves.

Q I will not dwell on this because Mr. Fenerty has already referred to quantity, but I gather after hearing the evidence presented by the representatives of the Gulf Company yesterday before this Board, you are not making any change in your computations as to the reserves in Pincher Creek?

A No, I would not.

Q You heard the evidence of Mr. Ralph E. Davis, with regard to his estimate of the reserves in the Viking-Kinsella?

A I believe I did. I listened to Mr. Davis.

Q It was 612.5 billion to 200 pounds per square inch gauge. In the light of that evidence have you any alteration to make in your computation for that field as set forth on page 5, which shows 435 billion?

A No. I think that my estimate is satisfactory. As a matter of fact, if this Province did not have a good Conservation Act and if I did not know that this Province was sold on conservation, I probably would apply to these marketable gas reserves an even greater percentage to the marketable factor than the one I showed.

J. O. Galloway,
Cr. Ex. by Mr. Martland.
Cr. Ex. by Mr. McDonald.

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Q And did you hear the evidence of Dr. Beach with reference to what we might call the Pakowki Lake Area, Pendant d'Oreille, Manyberries and so on?

A I believe I did. I am not certain of it. I might not have been here at that time.

Q That does not alter your views as set forth in your submission with regard to the reserves there?

A No, it does not. I made a careful study of the well data and prepared from that well data a contour map, and as I believe I stated in here, in the Pendant d'Oreille area, I was not able to determine that there was more than one production member present down there, although I realize many engineers did use a good many possible producing horizons.

Q You realize you are in substantial disagreement with Gulf as to Pincher Creek, Mr. Davis as to the Viking-Kinsella and with Dr. Beach as to Pakowki Lake?

A I certainly realize that.

CROSS-EXAMINATION BY MR. McDONALD:

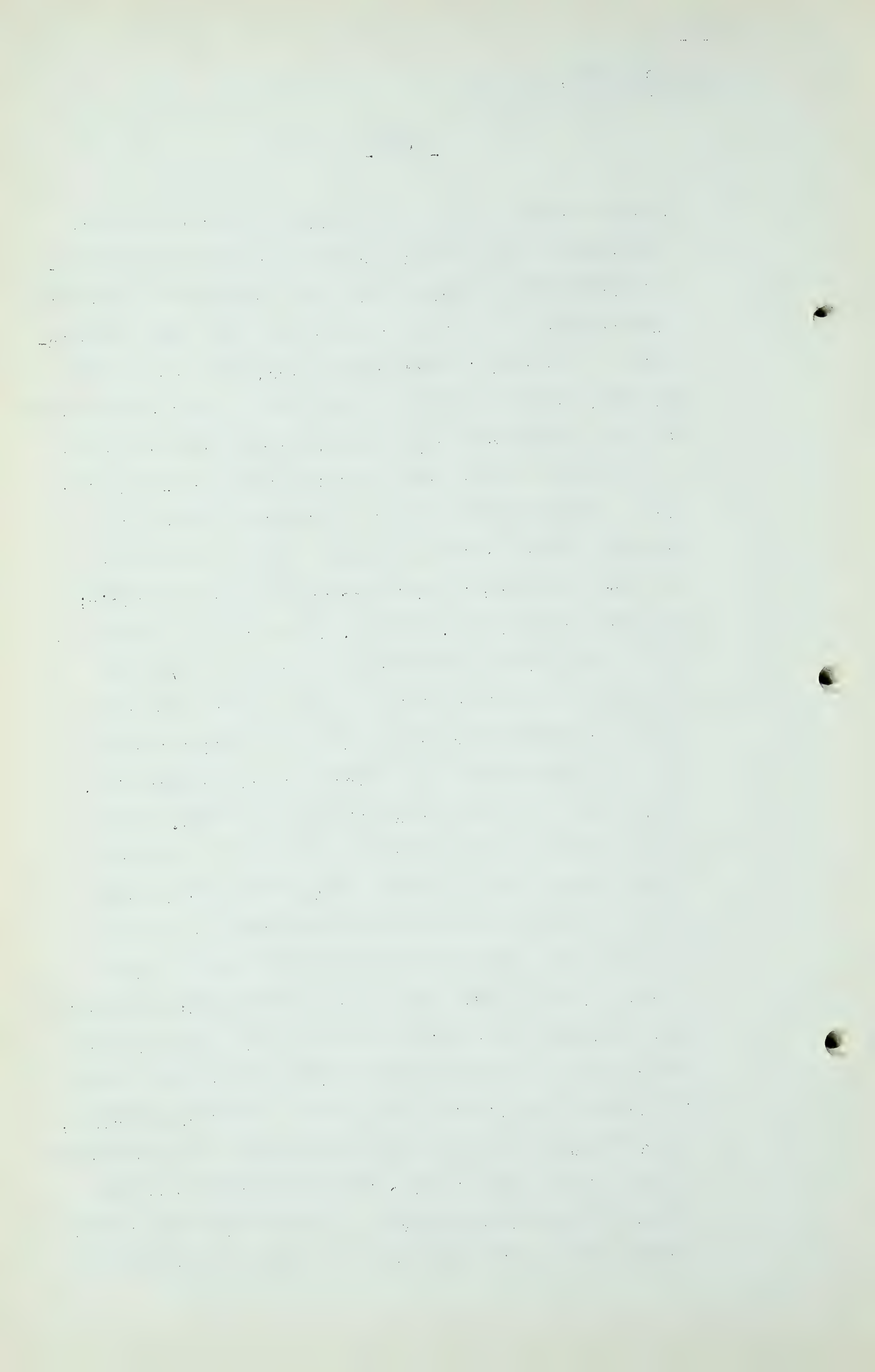
Q Dealing with J-33, Mr. Galloway, I know you refer to the Morinville area and in your Table following page 15 you show 500 million of marketable gas. Would you care to enlarge upon that, upon your reasons for putting that amount on that in your tabulations? You refer to it again on page 16, at the bottom of page 16.

A Yes, I have found it here. I refer to the area in Townships 54 to 58 and Ranges 24 to 28 of the little map in the back part of my analysis as the Morinville area.

J. O. Galloway,
Cr. Ex. by Mr. McDonald.

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I made a study of that area because I was interested in attempting to determine whether or not there were measurable marketable reserves there and I came to the conclusion that the time is a little too early to make that determination. However, in that general area there are so many gas wells with substantial flows that it would be difficult for me to understand any exploratory geologist who would not consider it as a very promising future gas-producing area. In the method I use in estimating reserves it requires several primary factors. Among them would be the type of production which occurred in the reservoir; the type of reservoir, perhaps, along with that study but then I must have a determination as to the gas/water contact and then in addition to that I must have some method of determining or some method of delimiting the size of the structure from which that gas accumulation, or in which that gas accumulation has occurred. So that at this stage of the operation, sir, I do not believe I could prepare, or I would be unwilling to prepare what I would consider to be an accurate appraisal or an honest appraisal in my opinion of the marketable gas reserves there. I must admit that it is a future great prospective gas-producing area and in an area of that size it would be my opinion that eventually it will produce something in excess of 500 billion cubic feet. I prefer, naturally, in making an appraisal, to use the factors I have referred to to arrive at what in my opinion would be an accurate figure on marketable reserves. I do not have that information there. Still there are too many shows of gas and



J. O. Galloway,
Cr. Ex. by Mr. McDonald.

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too many gas wells in that general area for it to be considered as anything other than what I have stated in my opinion.

Q Thanks, Mr. Galloway. I was wondering if you would refer to J-34, to the Deliverability Calculations of the Pincher Creek Field?

THE CHAIRMAN: That is J-35.

MR. McDONALD: J-35, I am sorry, sir. I would just point out some differences between your calculation and that submitted by Dr. Hetherington in his Exhibit J-31. Now you take in the 11th year at an average pressure of 3291 the average potential arrived at by Dr. Hetherington's method was 29 million cubic feet. Then on the 18th year the average pressure, 2300 pounds per square inch absolute. Dr. Hetherington's average potential of that well was 12 million cubic feet. Have you any statement to make that would indicate the difference in your estimate?

A I do not know how Dr. Hetherington prepared his but this one is based on a slope of .85. The reserves which I have used in my analysis and the average daily, the average potential of the well.

Q Yes, and then again you had a much larger amount of gas in place. You had 2700 billion cubic feet of gas in place whereas his is 1825?

A Oh, yes.

Q That would make a considerable difference?

A It would in that one column on the left.

Q And then he used a deliverability curve slope of 1.15?

J. O. Galloway,
Cr. Ex. by Mr. McDonald.
Exam. by Mr. S. B. Smith.

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A Dr. Hetherington did?

Q Yes.

A That would make a difference. This is based on a slope of .85.

EXAMINATION BY MR. S. B. SMITH:

Q I understand the facts are that you completed the results of your studies and you furnished the results of that study to the Prairie Pipe Lines Limited before the amalgamation of that company with Pacific Northwest?

A I believe I did. I think I presented that to the Prairie Company before I heard of the amalgamation.

Q That was away back in the early part of the summer. You can give us the exact date if you want it from your own files?

A I think I have a letter of transmittal in which I included the tabulation. I think it was late July or early August.

Q The figures you then gave were substantially the figures you have given here today?

A That is correct.

Q And that was at a time when Prairie Pipe Lines were applying for a permit to export 170 million cubic feet per day with a peak load requirement of 225 million cubic feet per day? Your figures were furnished to the Prairie Pipe Line Company at that time.

A My memory does not go back that accurately, Mr. Smith.

Q But you do remember about the time and it was approximately the end of July or the beginning of August?

A Yes.

J. O. Galloway.
Exam. by Mr. S. B. Smith.

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Q And you can get us the exact date from your files if that is material?

A I can give it to you exactly because I am certain I must have a letter of transmittal.

THE CHAIRMAN: I think we might adjourn till 2 o'clock. The Board hopes we will be able to finish this up this afternoon. The Shell Company intends to make a submission to the Board. I understand it is not ready and it is doubtful if it could be ready by Monday. If it is acceptable to counsel, we will ask Shell to file the report with the Board and we will send copies to the interested parties without having someone present it formally. If that is satisfactory. If there is no objection.

MR. NOLAN: That is satisfactory as far as my client is concerned.

MR. S. B. SMITH: It is quite satisfactory to our company.

MR. MARTLAND: Satisfactory, sir.

MR. McDONALD: It will be satisfactory to my client.

THE CHAIRMAN: Then we will adjourn until 2 o'clock.

(At this stage the hearing was adjourned until 2 P.M.)

2 P.M. SESSION

THE CHAIRMAN: The Board is prepared to sit tomorrow morning in order to clean this up if we cannot finish this afternoon. Now, Mr. Smith, do you wish to

J. O. Galloway,
Exam. by Mr. C. E. Smith.

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question Mr. Galloway?

JOHN O. GALLOWAY, Continued.

EXAMINATION BY MR. C. E. SMITH:

Q I think practically everything I wanted to ask has been asked except probably one thing. On page 3 of your submission, that is J-33 under your heading "General", you do refer to Morinville and you say, "In any event, an experienced observer is justified in stating that the accumulation there is in the order of 500 billion cubic feet and upwards." I take it that even after your discussion with Mr. McDonald, you are still content to leave your statement there, with that explanation you have given?

A Yes, I think that statement is all right. It is not a measured reserve but the accumulation over the area, if we take the larger dimensions, some 4 to 6 townships, so I think an experienced observer would state that either there were a number of small fields in that general area or that it was an area which contained a large field and one or more small fields. So that in considering an area of that magnitude and considering the thickness of the zone and the accumulation as indicated from the well tests there would be a major reserve there and I have simply made a rule of thumb estimate of 500 billion.

Q That is what I mean. There is no qualification except with respect to your explanation now?

A That is right.

Q And to your submission statement, that is all I want. Now I was wondering if you could assist us in any way

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J. O. Galloway,
Exam. by Mr. C. E. Smith.

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with respect to a field we have heard considerable about in the last two days. You remember Mr. Hawthorn mentioned Whitelaw in J-25 as some of the important discoveries and developments in 1950, and I do not know whether you remember it or not but on page 9 he suggests, and only suggests, this: "Up to 50 billion cubic feet per section can be approximated but at this time there is no way of telling how extensive the reservoir may be." I simply draw that to your attention. You will also remember Dr. Nauss' evidence with regard to Whitelaw. Have you had any opportunity of forming any opinion, even though you have not much data or basis, can you assist us at all about Whitelaw?

A No, I know nothing about Whitelaw except what I have read in the Press.

Q Or heard here?

A Or heard here at this hearing.

Q So that you cannot assist us in any way or give any opinion or guesstimate or anything of that nature?

A No, I would not care to make that type of an estimate or guesstimate in regard to that area at this stage of the operation. I would need more information so far as I am concerned in order to make any kind of a rough estimate even, of the amount of gas that might be there.

Q I see. That is all, thanks.

A May I say something further? There are one or two typographical errors or omissions in this brief of mine. I would like to refer to them if I may. On page 4 under the Compressibility Factor I do not have the laboratory tests for that determination, but when I referred this

J. O. Galloway,
Exam. by Mr. C. E. Smith.
Exam. by Dr. Govier.

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back - it was called to my attention some time ago, and when I referred it back to my formula that I use, I am of the opinion that 0.908 probably should be in the order of something like .965. If that is correct it would reduce the estimation of the reserves on page 5 to 604 billion and after applying the recovery factor of 85% it would make a figure of 397 billion. Then over in the tabulation which follows page 15, in the third area referred to there, Jumping Pound, the acreage figure should be 6000. I do not know how the 6300 got in there. I failed to check it.

Q DR. GOVIER: Where is that again, Mr. Galloway, please?

A In the tabulation following page 15.

Q MR. C. E. SMITH: Does that change any of the other figures opposite Jumping Pound?

A No, it does not because back in the computation the 6000 figure was used. Then in the tabulation Viking-Kinsella of course your marketable gas should be 397 making a total of 4.15 instead of 4.18. I believe that is correct. The same correction should be applied in the column called "Reserves to 100 pounds" making that 6.186. Those are all of the errors I know of.

EXAMINATION BY DR. GOVIER:

Q Mr. Galloway, your table which follows page 15 was drawn up along the same general lines as Dr. Nauss' Revised Table A, I believe, is that not right? The same general pattern seems to be used?

A Well, I do not know that, Dr. Govier. I am not familiar

J. O. Galloway,
Exam. by Dr. Govier.

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with Mr. Nauss' method.

Q Do you have a copy of Dr. Nauss' table that you might give Mr. Galloway?

MR. McDONALD: Yes, I have.

Q DR. GOVIER: It seems to me, Mr. Galloway, that the general set-up was about the same but yours differs markedly from Dr. Nauss' in being shorter than his, because you have left out quite a few of the fields or areas Dr. Nauss has indicated. I wanted to ask you whether you have left out - for example, Dr. Nauss has a field Pouce Coupe on the grounds that you do not believe there is a reserve of gas which can be estimated and considered to be marketable, or whether you have left them out on some other grounds? I am just using Pouce Coupe as an example. There are about 55 or 60 other examples of that same type.

A I did not consider that because I wanted to analyze the gas reserves of the Province with respect to the problem which is facing us here now and that is whether or not export in this general area should be permitted.

Q What do you mean, "this general area"?

A Well, the general area in which the large percentage of people live. It would seem to me that since I am sold on the protection of the local inhabitants that the consideration of the reserves here should be primarily in this general area where they can be, where an export system, if such is permitted, is developed the gas reserves can be taken to it. And these gas reserves here in this general vicinity of Eastern and Southeastern Alberta - pardon me,

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I should say the problem is of a different character here than it would be up in Pouce Coupe, in my opinion.

Q Does that mean that the Board should interpret your figure of 4 point something trillion cubic feet of marketable gas as being your estimate of the marketable gas immediately adjacent to the populated areas of the Province, is that correct? I am sure you can see my problem, Mr. Galloway. We have many estimates now of gas reserves in the Province and we appreciate the difficulty of estimating, particularly in cases where there is not very much data. But when one man comes along and assigns a reserve to Pouce Coupe, for example, and another man does not even include Pouce Coupe in his list, what are we to think?

A Well in my opinion your question of the problems which are bothering you, like most other problems here in relation to these applications, is related to economics. I do not think it makes any difference as to how much gas you may have somewhere, and you may have quite a substantial supply of it there, so long as that somewhere is economically out of reach. Now that does not mean in the vicinity of Pouce Coupe it would be economically out of reach of the people of Pouce Coupe. I do not mean that. I mean when we consider the general problem of analyzing the matter of exporting natural gas, while we might decide we have lots of gas somewhere in great quantities, it should not be pertinent to our problem unless economically we can reach it.

Q Yes, I certainly appreciate that point, Mr. Galloway, but does it follow then that your tabulation of reserves are

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those reserves which are within economic reach of the Province's large consuming centres and within economic reach of the proposed export lines of your client, is that correct?

A Well not necessarily of my client, but of anyone who might wish to export it.

Q Suppose somebody wants to build a line that starts up in the general Pouce Coupe area, what about Pouce Coupe under those circumstances?

A Well, I think that Pouce Coupe or the accumulation in the vicinity of Pouce Coupe will become a very important factor because at some stage the exporter or the marketer will have to finance his line and at that time he will consider whether or not he can make a profit by taking gas from there to the consumer.

Q Let us consider another example that does not involve the route of any of the pipe lines being considered, the example of Provost. Dr. Nauss indicated a marketable reserve of gas of 100 billion cubic feet. Dr. Hetherington has indicated that that gas could be considered as a supply to the Northwestern Utilities system and he has told us that in his opinion it would be economic to pick that gas up. Should we, from your submission, gather that in your opinion it would not be economic to pick up the Provost gas or should we gather that you do not believe the reserve there is either big enough to worry about or one that you could estimate? How are we to interpret the omission of Provost from your tabulation?

A Well in my tabulation I considered only what I would call major reserves. I realized that if any smaller reserves

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than these lay adjacent to and within reaching distance of a major reserve it probably would reach the market. It would reach the market if sufficient gas could be obtained from the smaller area to justify a line going over to it. So that I have not considered in my analysis anything other than what I would call major reserves. Now, in addition to that I have not considered those areas and many of those on the tabulation I have before me - - is this the report of Dr. Nauss?

Q Yes.

A Many of those would be reserves which I would hesitate to compute. I would say that there is insufficient information available at this date for me to make an appraisal of the marketable reserves in a large majority. So I see no purpose being served in my analysis, I see no purpose served in my analysis in trying to give an evaluation of which I cannot properly appraise.

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A So that I have omitted them from my appraisal. It does not mean that eventually one or more of those will be great accumulations of major size but at this stage if I were controlling the finances needed to reach for gas there I would not approve of the expenditure until I had more information on the area.

Q Would you quarrel with another estimator who wished to take what was available and make some numerical estimate of the amount of gas, for example, in Pouce Coupe, Pelican, Legal or any of those? Would you quarrel with somebody who wanted to do that?

A Not at all. Again, let us assume that I was a gas company, I might say to the company that owned one of these smaller, possibly smaller reserves, one that we can not yet appraise properly, I might say to the executives of that company, "We have made a cursory glance at this and we think you might have a lot of gas over there and I will tell you what we might do with you, if you would develop that so we can properly appraise it we will be prepared to discuss arrangements with you whereby we buy some gas for you." Perhaps that illustration I have given you there will clarify my position.

Q I certainly see the point on a field where it is a long way from any present day market or where there is very, very limited data, but there are some other cases too. Another example is the solution gas at Leduc D-3, which as I recall, you meant it was not included in this?

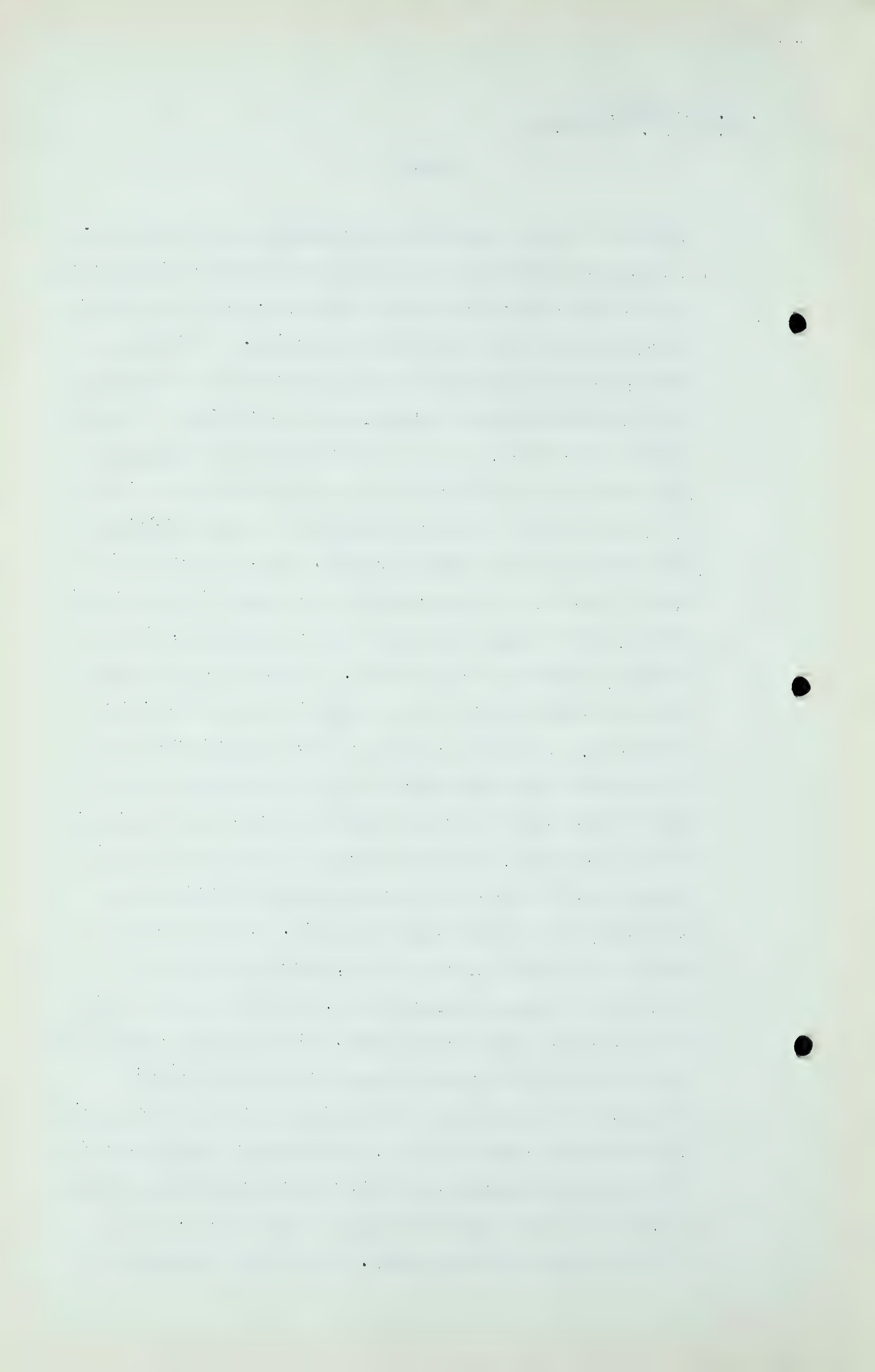
A No, it was not.

Q Now, why was that not included, Mr. Galloway?

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A Because I did not know how much actually will be marketed. I can make a guess but my guess will be based on an analysis of the crude reserves and the overall gas-oil ratio existing throughout the life of that production. It will be based on the assumption that the gas will not be requiring repressuring either at Golden Spike or Atcheson or Woodbend or some other place. It will be based on an assumption that even if it is available it will be economic to collect it. And a number of other assumptions of that character will have to go into that appraisal. Now, I would also have to place in that appraisal an estimate of the recoverability, and I might say that the recoverability, for instance, was 20%, I do not know. I can not say at this stage how much gas will be returned if I use it for repressuring. I know we can deduce that theoretically but I find that in my experience in the oil business that my type of work can be divided into two parts, the theoretical and the practical, and theoretically we can do a lot of things which in practice just do not quite work out as favourably as we would like to see it. So that when we come to the practical side of it, which involves a lot of capital, things of that nature, we have to put a factor in there which keeps us on guard. So that when I approached the solution type of gas in these various oil fields I will grant to anyone that there will be substantial amounts of gas produced with the oil. It has to be that way because oil is produced with gas but just how much will be utilized for sale I do not think I can say at this time, and I do not think anyone else can say. But if some one wants to



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say there is 100 billion available I might say to him,
"I might grant that your figures are right but in practice
I think that you are a little optimistic."

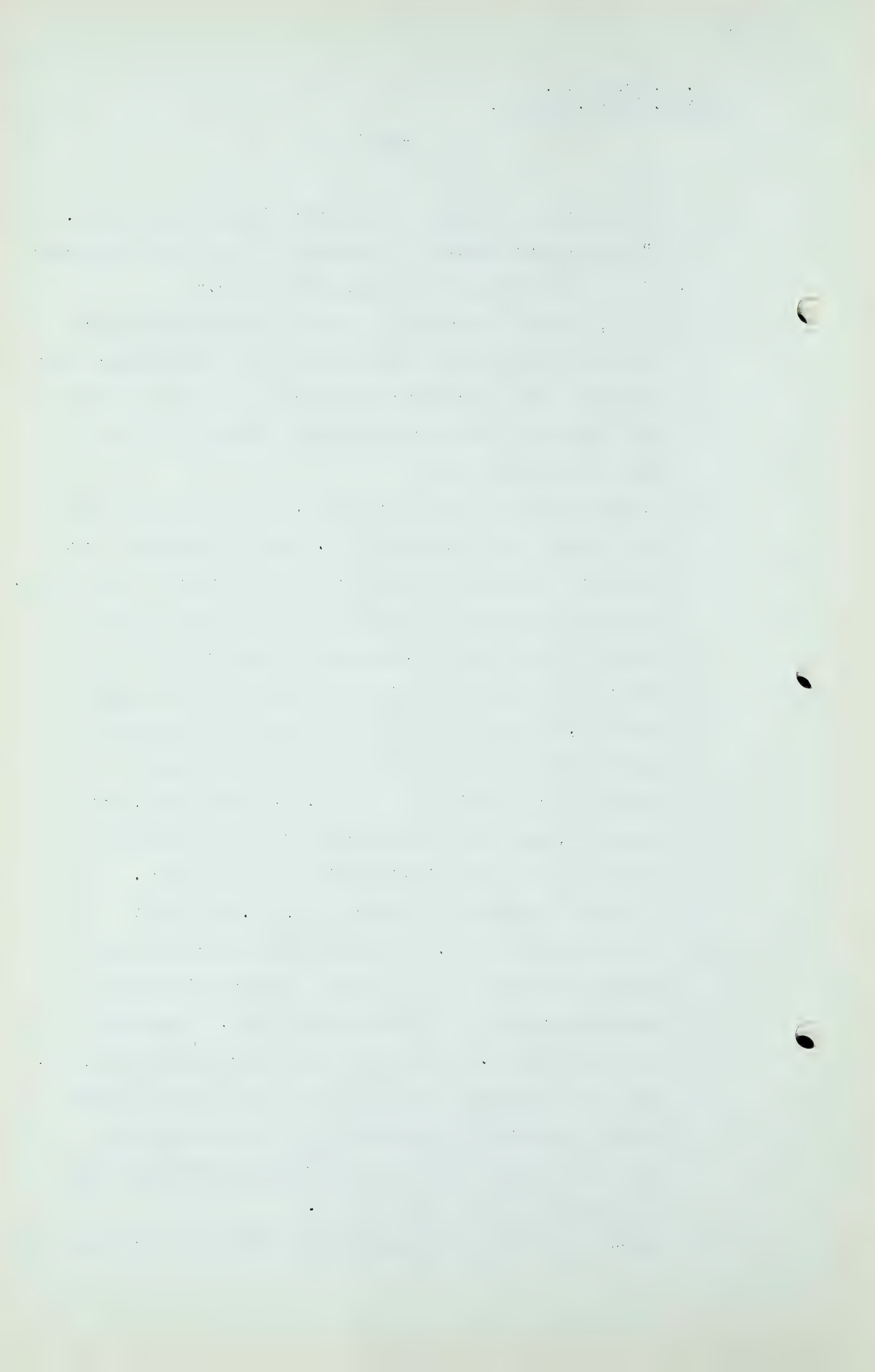
Q Well, I gather then that you would consider that North-
western Utilities were behaving in a very theoretical way
when they made a contract to purchase that very gas and
have expended a considerable amount of money to build a
pipe line to handle it?

A I think they are being practical. If they can get that
gas I think they should buy it. There is nothing wrong
with that but that does not conflict with what I have said.
As long as they know there is going to be gas produced
there they can take it, as long as they can get it at a
price which would justify the taking of it they should
take it, but they should at all times keep themselves in
a position so that if they had to forego taking it they
would be in a position to do so. I do not know, for
instance, what the average rate of production will be at
Leduc for the next four or five or three years.

Q You would not care to estimate it, Mr. Galloway?

A I could estimate it. I do estimate it because I need to
estimate it but I realize when I estimate it there are
some reservations in connection with it. I heard the
testimony of Mr. Pot and I was very much impressed by it,
and I am very much impressed by his ability but I think
with my experience I realize some of the assumptions
which he has taken into consideration and possibly some
of which he did not recite here.

Q Does it add up to this then in that particular case that even



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though an experienced gas utility company are prepared to contract for gas and build a pipe line to handle that gas that you are not prepared to estimate the amount of gas that might be available from that source because of the uncertainties of the sort you have mentioned?

A I would not be prepared to estimate the amount which would be available over a long period of years unless the gas company were to say to me, we will not need more than 15 million a day or something of that nature. Then I think I would say to them, "I think you are safe in doing it," but if they say to me, "We are going to need 100 million a day," or some such figure, "and it is going to cost us a certain amount of money to do that," then I would go at it very carefully before I made the expenditure. Let us be certain that we do not lose our investment. In the same way I have no way of knowing at this time whether or not the investment of Imperial Oil in their extraction plant there is economic.

Q But you know it has been made?

A I know it has been made but I do not know the reasons why Imperial made it. Now, sometimes when you go behind those reasons you find that companies will make expenditures which have only a bare chance of paying out but they have their reasons for making the expenditures.

Q Well, Mr. Galloway, then would it be proper in your opinion for the Board to consider your estimate as a most conservative one? Do you think that would be proper?

A I think it is absolutely proper because I have attempted to make it on a very conservative basis.

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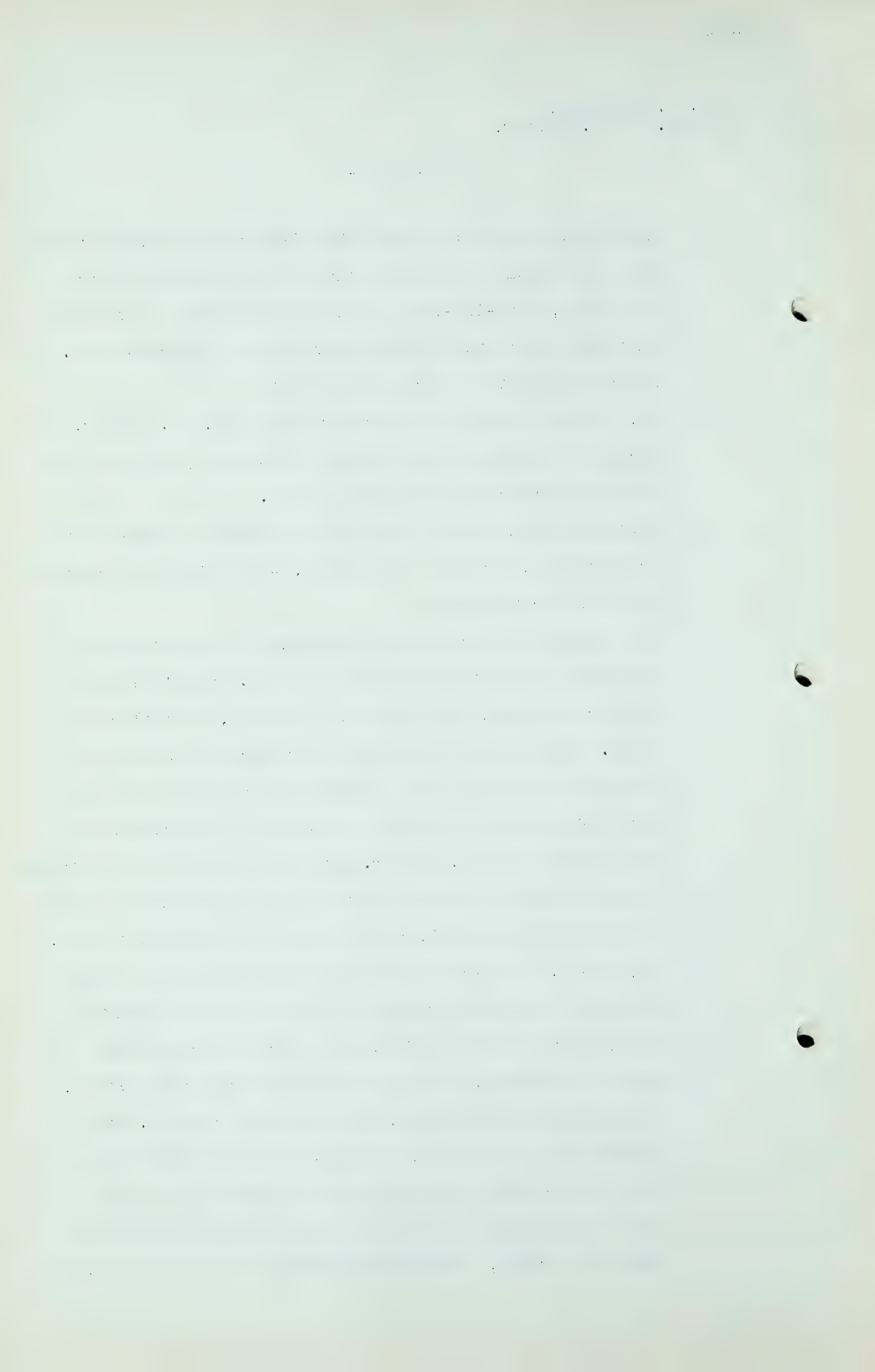
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Q And would it also be proper for the Board to consider that while you would not stick your neck out quite as far as Dr. Nauss, none-the-less you would not wish to deny the fact that there may be marketable gas in the amount Dr. Nauss suggests? Is that proper too?

A Oh, I would promptly go further than that, Dr. Govier, because I would say that the gas producing potentialities of this Province are very very great.

Q Suppose we stay within the realm of proved or proven and probable gas, whatever that means, what would your comment be in that connection?

A Well, many of the appraisals and many of the estimates of reserves made on this tabulation of Dr. Nauss's I would not care to make, and that is, of course, no reflection on Dr. Nauss or any other appraiser such as he who is properly qualified, but it would mean that I need some more information in order to arrive at an appraisal in many of those areas. If Dr. Nauss said to me that certainly I could not be in disagreement I might agree that I could not be in disagreement, but I would say I would not care, as you say, to stick my neck out that far as this stage. I think in order to properly appraise the gas reserves in any area you need information which you can accept beyond a reasonable doubt in regard to the areal extent, the thickness of the zone, the water-gas contact, and perhaps one or two other factors. When you have those then you are safe in going ahead because in the work which we have done of that character we realize that we may not be right, that when we assume that there is 5,000



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acres in a narrow, elongated shape we may be wrong in that shape, that it will have a little bit different shape, but in the long run we will probably come out with 5,000 acres or approximately that amount when we have the basic information which I enumerated a moment ago.

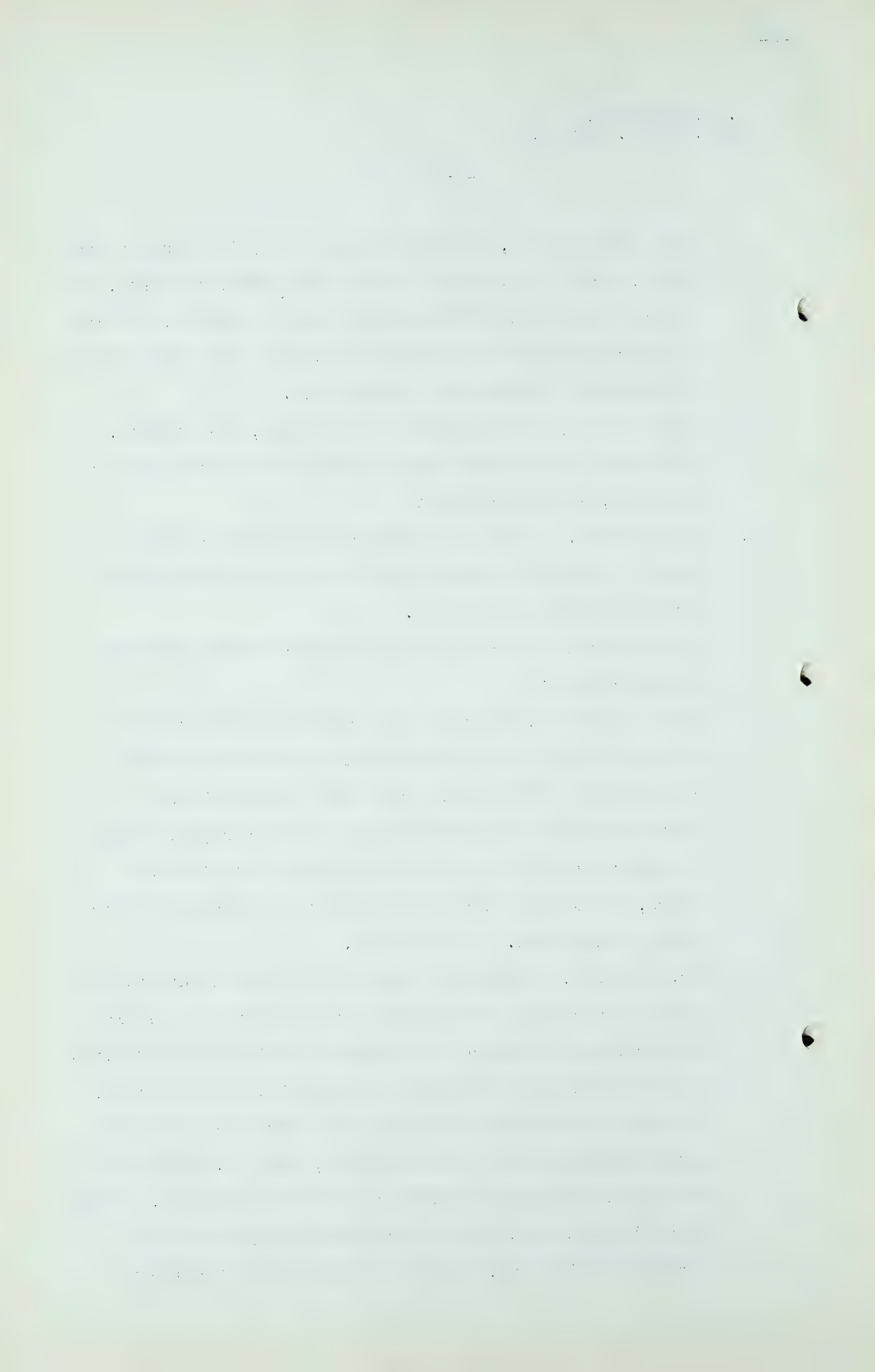
Q Would you say in the case of Pouce Coupe, for example, there was insufficient basic information to make such an estimate, is that correct?

A I would not. I did not consider Pouce Coupe because Pouce Coupe in my opinion is not related at this time to the problem which is facing us.

Q You excluded it because of the distance from large consuming centres?

A That is correct, because I was primarily influenced by the problem of retaining here for the people of this Province and particularly those who are now being served by those two distributing systems a supply of gas to ensure that they would be protected for 30 to 50 years, and I would not be interested in making any other kind of appraisal. I live here.

Q Mr. Galloway, suppose you were in the Board's unfortunate position and had to decide as to the reserves of gas in the Province of Alberta, and suppose that you wanted first to decide the total reserves of gas within the Province, and then after knowing the total you were then going to give consideration to the economics, that is, whether we can reach the field or whether we can not reach it, if you were the Board and if you were going to approach the problem in that way, would you lean heavily towards a



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figure such as 4.15 trillion or would you lean toward a figure such as 7.063 trillion for this total figure I am talking about?

A No, I would not lean either way on that particular factor. I do not believe that anyone at the present time can compute the natural gas reserves in this Province. I think that the potentialities and the indications of gas as indicated by the appearances of the gas are very great and are much in excess of 7 trillion.

Q Well, Mr. Galloway, I asked you to assume you were in the Board's unfortunate position.

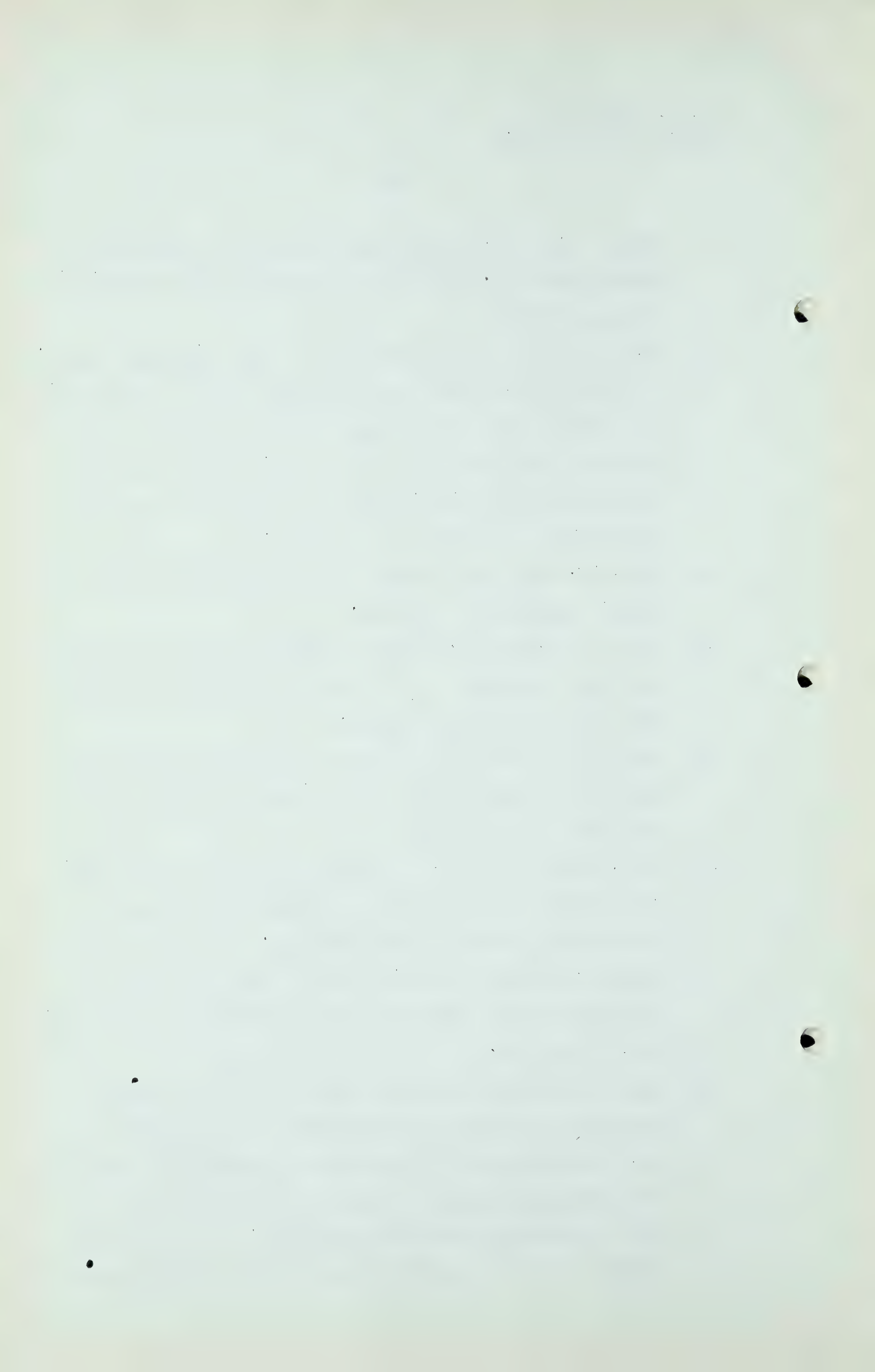
A Well, if I were, Dr. Govier, I think I would try to talk my other associates out of trying to determine how much gas there is in this Province.

Q Do you think that if you were in the Board's position you could do that in the light of the Act under which the Board is operating?

A Well, I would say that I think you are in a very difficult position if you have to estimate how much gas actually is present in this Province. I do not believe anyone can do so, so that it would seem to me that if you have to do so you should take something in excess of, say, 7 trillion.

Q Despite the fact that we received an estimate from a qualified estimator in the amount of 4.15 trillion?

A Oh, but my estimate is not based on the amount of gas in this Province because I thought that that would be the next step which this Board would take. If you have to estimate how much gas is in the Province, that is one



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thing, and I think that if you have to do that take some figure which seems to be fair to you, but the next step must be how much gas have we got on hand to justify this Board granting an export permit, and so far as I am concerned that is the most important problem you have before you.

Q And that is really what you mean by this word "certain" that appears before your title, "Certain Gas Reserves"?

A That is correct.

MR. C.E. SMITH: I did not interpret it that way. I did not know that was the interpretation of the word "certain".

A Pardon me, maybe I misinterpreted the question.

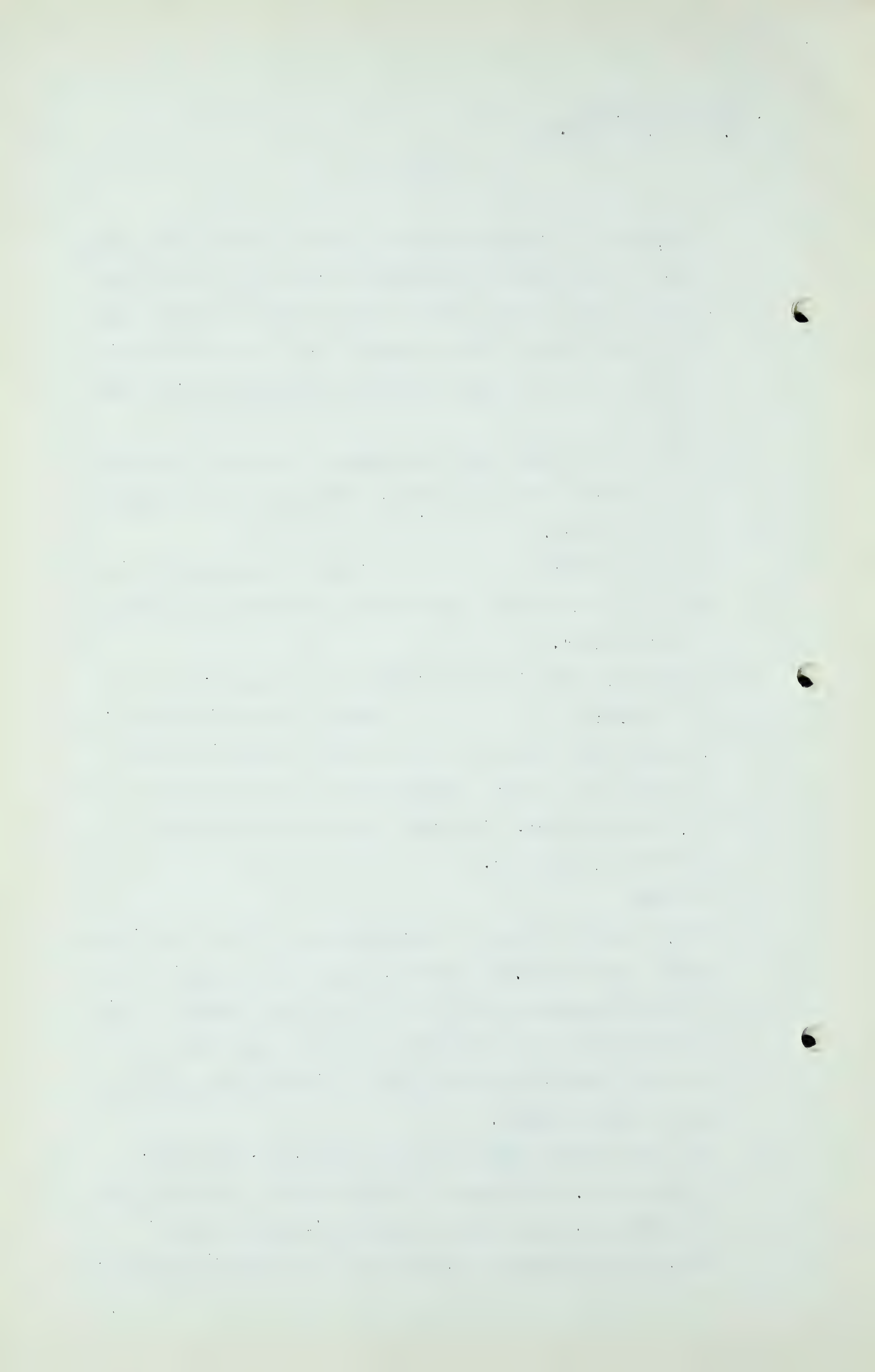
Q DR. GOVIER: Maybe I misinterpreted it. In what sense did you intend to use the word "certain" in the title of your tabulation? Is it positive or - -

A No, as particular. "Certain" used in the sense of particular, selected.

Q Select?

A Yes. And my estimate of marketable gas in the last column, which should be 4.15 plus 500, would be the figure which I would consider as the gas in hand which should be given consideration in deciding whether or not the Province would be protected sufficiently to justify the granting of an export permit.

Q Can that be all added up to mean this, Mr. Galloway, that this 4.65 trillion is the gas which in your opinion is within economic reach of Alberta's present major markets plus perhaps a pipe line to the Prairie Company,



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is that correct?

A Will you ask the question in two parts? Leave out the Prairie Company and we will get to the Prairie second because I do not quite get the connection.

Q Well, I do not think I can. Well, let me ask the question this way. Would you define what you mean the 4.65 reserve to be capable of meaning? Maybe even that is not quite right. What do you mean by the 4.65 reserve, Mr. Galloway?

A I mean that there are in my opinion reserves in the amount of 4.65 trillion within relatively close proximity to the present systems and of sufficient size to justify the requirements of this Province for a period of approximately 40 years, and those reserves which I have considered are reserves which could be reached by the present distributing systems at a relatively low cost or expense.

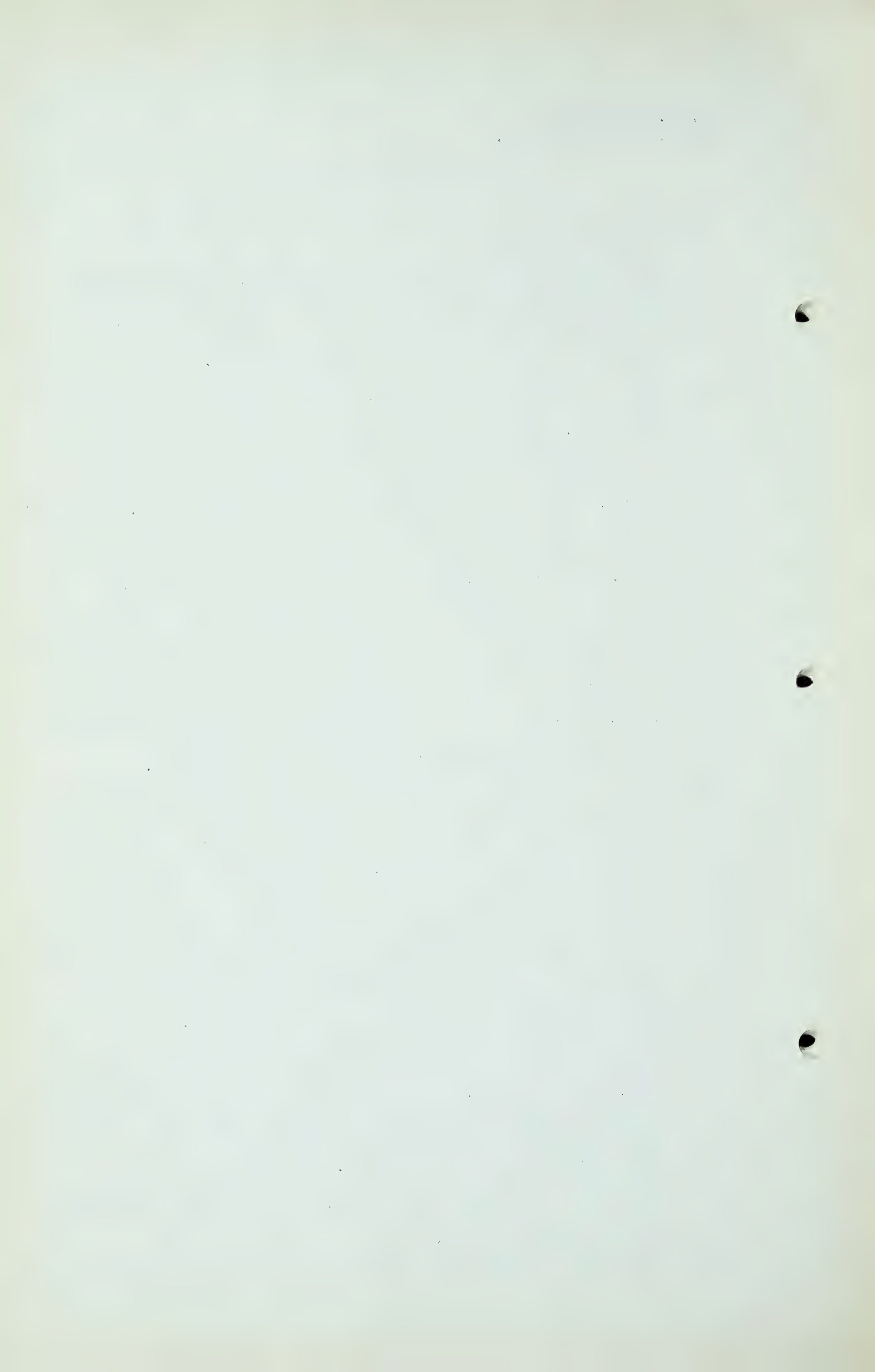
Q And any reserves not included in this list are in your opinion beyond that kind of economic reach, is that right?

A In one sense that is correct. It is true in this way that the other areas that I have not mentioned here would require additional drilling in order to properly delineate them and therefore at this stage would not justify the expense necessary to reach them by pipe line.

Q I have one or two questions in the body of your exhibit J-33, Mr. Galloway. On page 4 you give a thickness of 12 feet for the Viking-Kinsella area. May I ask you how that figure was arrived at, Mr. Galloway?

A I will see if I have some notes. It has been a long time since I computed that.

Q Perhaps you could just tell me whether it was arrived at



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by isopaching or planimetering a contour map or by averaging individual well figures?

A I think it was by averaging individual well figures.

Q Oh, that is fine. I have one other question here and I can not seem to find it. Where is your section on Leduc?

A It is page 5.

Q Oh yes, it is on page 6. You give a thickness of 75 feet, which I assume is your estimate of the thickness of the gas cap, is that right?

A That is correct.

Q That seems very large, Mr. Galloway. Where did that figure come from?

A It was taken from the contour map of the field as prepared by me.

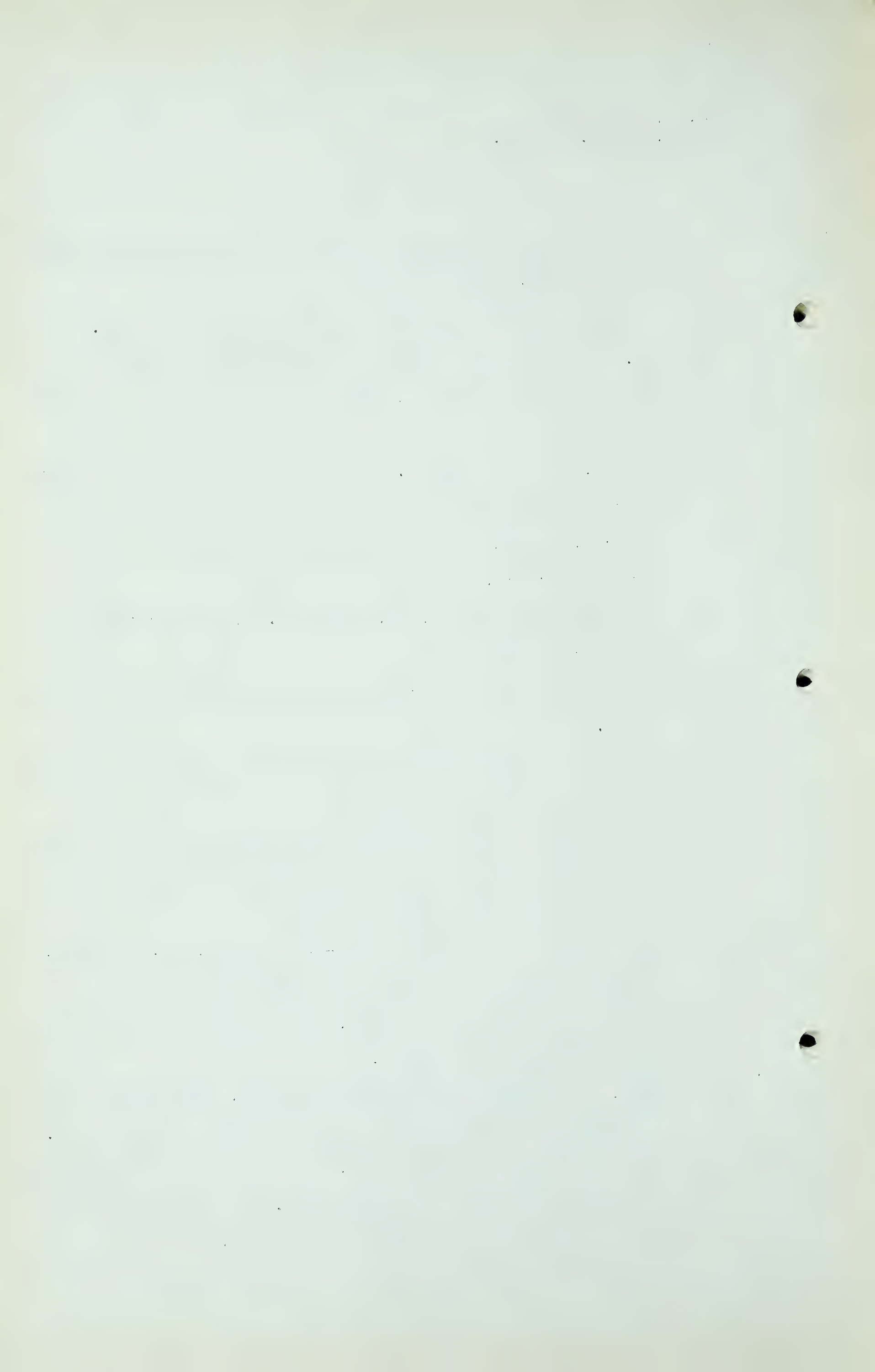
Q And that is the average thickness of the gas cap? It does not include the underlying oil?

A That is the average thickness in my opinion of the gas cap and it meant that I must run off into the Leduc-Woodbend area and make some estimates there.

Q With respect to your Exhibit J-35 I wonder, Mr. Galloway, if you would be good enough to explain just briefly one of the charts in this exhibit, any one you like, Pincher Creek or any of the others.

A Well, we can take the Manyberries first. The chart which is attached to it is merely the tabulation in graph form. They both mean the same thing. The data on the tabulation is simply plotted on the graph form. The estimate of raw gas in place is the estimate in column 1.

Q And that initial figure - -



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A Is the estimate which I made of the reserves.

Q Well now, referring back to your table. Where do we get that figure, 101 billion?

A That is raw gas in place on the tabulation following page 15. They are shown as A Sand and B Sand, 40 and 61, raw gas in place.

Q That is listed as reserves to 100 pounds?

A That is correct.

Q You are assuming that as the same as raw gas in place, are you?

A Well, for this purpose it is. The reserve is computed by me in Exhibit J-33 as the reserve which is shown in that column, and that column in other words begins with the reserve figure shown and the tabulation following page 15 is reserves to 100 pounds.

Q I see. In one place you call it reserves to 100 pounds?

A That is right.

Q In Exhibit J-35 it is entitled "Raw Gas in Place"?

A That is right.

Q It is the same figures?

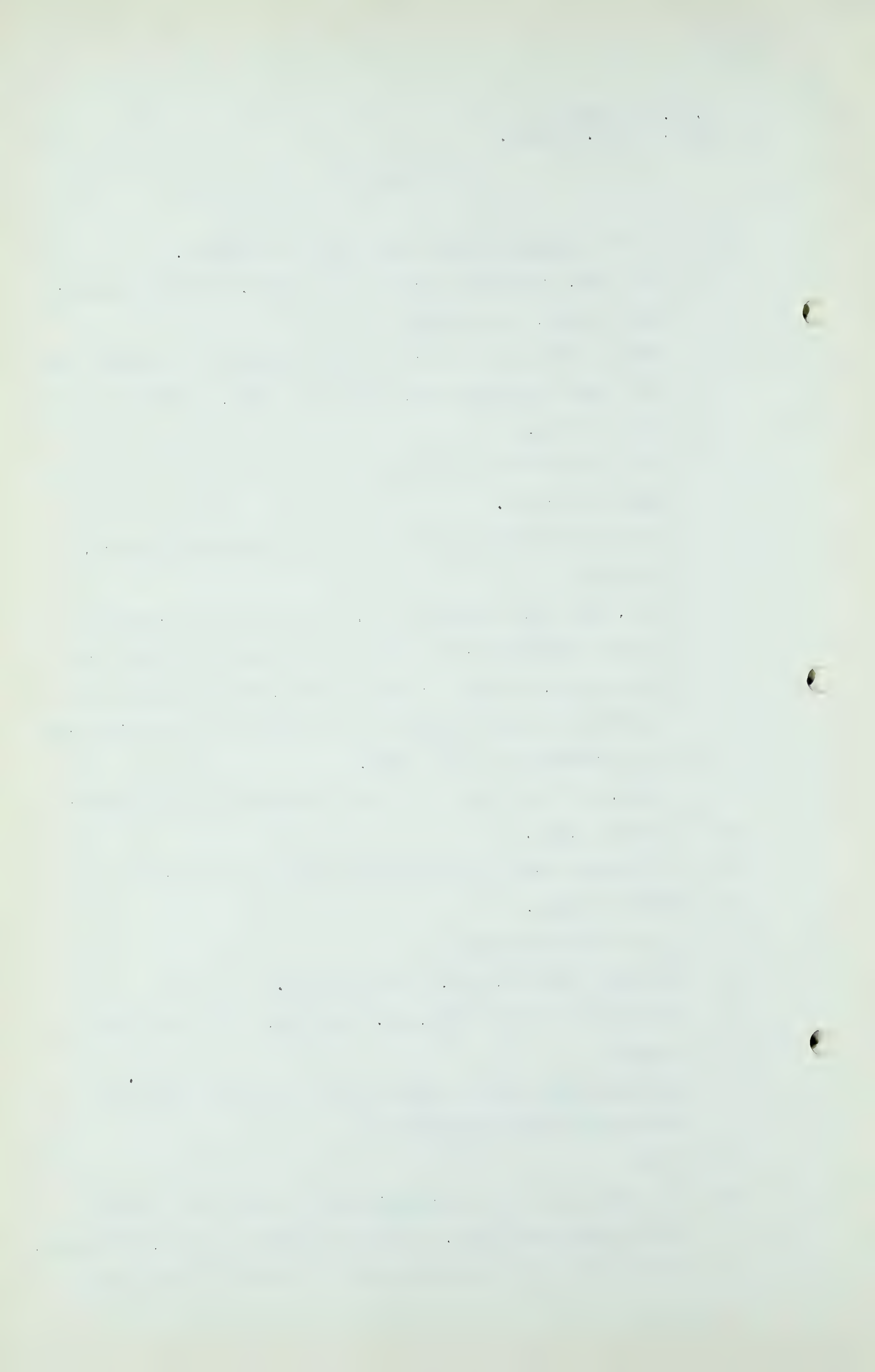
A The same figures, yes, that is right.

Q Would you continue then, Mr. Galloway, to explain the table?

A The marketable gas in place is in the third column and that is the figure which is - -

Q Yes?

A --- which is in the tabulation and in the last column called marketable gas. And the average pressure, of course, is the one which again came out of my Exhibit J-33, and



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the average potential of the well is taken from the records of the wells and as a rule is an average of the potentials that have been obtained in that particular area.

Q That will be an average open flow?

A That will be an average open flow.

Q For as many wells as you can get information for?

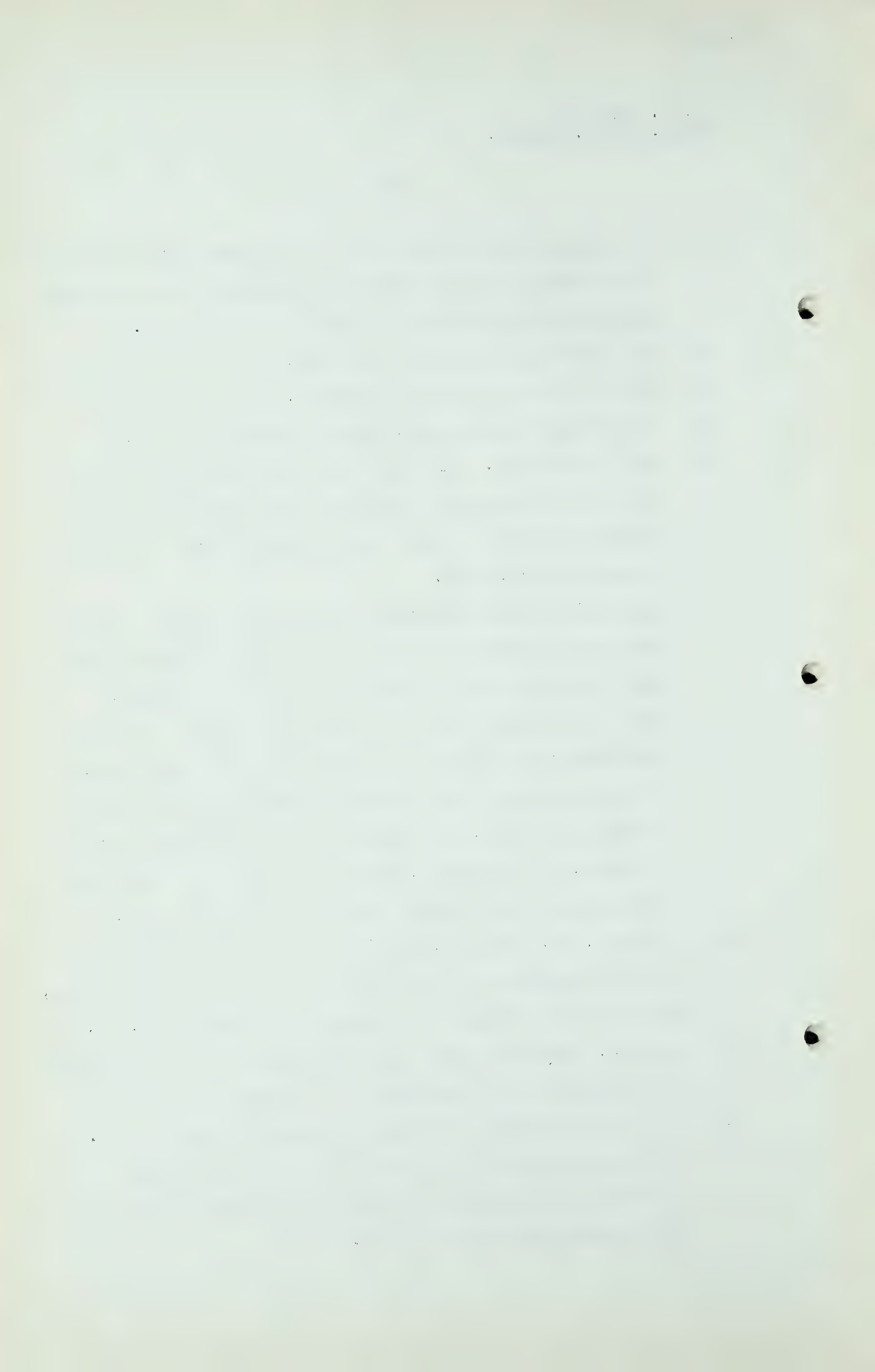
A That is correct. And then after that the slope .85 was used in estimating the production by years, and then as it was produced by years the raw gas in place was reduced as shown in column 2.

Q Does this schedule represent an attempt to meet a certain particular market or does it represent a tabulation of what the Manyberries field could meet as a minimum?

A That is correct. And if you want to produce any particular amount you would simply have to drill additional wells depending on the amount you wanted and the number of wells required. The average daily production per well is shown, it is assumed, and then it shows the daily raw gas produced and the daily marketable gas produced.

Q Tell me, Mr. Galloway, why is it in the third from the last column where you have per cent of potential produced, why are those figures for the most part around 10, 12, 14 and 15? Does that mean that these wells are not producing at their full legal allowable, you might say?

A No, I do not think it would be related to that at all. It would simply be the percentage as compared to the potential average daily production as shown per well in the column just ahead of that.



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Q Yes, it is .9 on that?

A Yes, .9.

Q And .9 out of 22.6 is 8.4%, is that right?

A That is right.

Q The thing that I couldn't understand about this Table was the Table seemed to be set up to give a constant daily marketable gas production of 5.5, or that 5.5 figure, you see, repeats all of the way down, and I wondered if you were trying to set up a schedule to meet some market requirement of 5.5, or whether this was supposed to be related to the ability of the Manyberries field to produce?

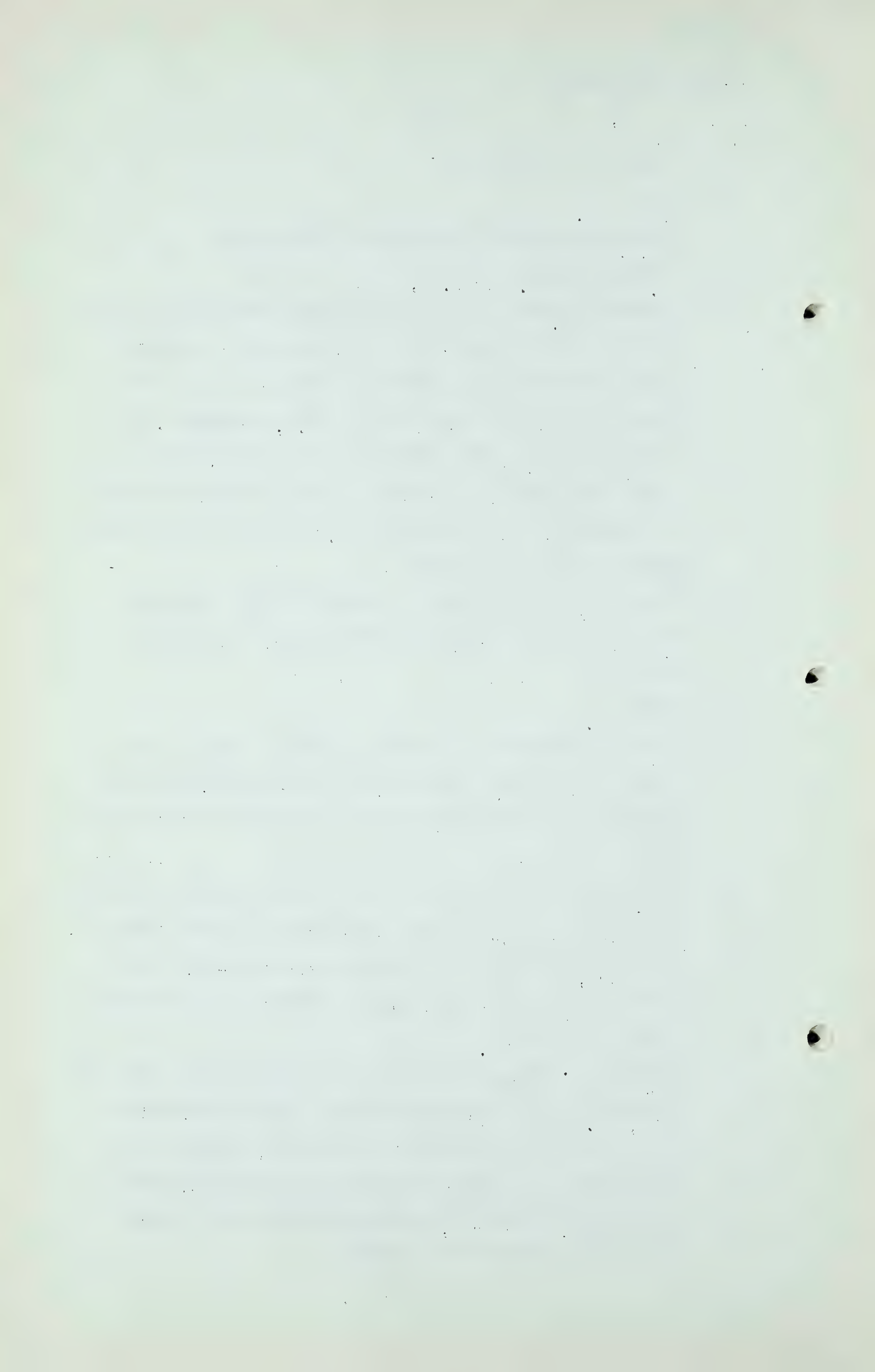
A No, I think it is simply related to the assumption of the amount of production which will be produced each well.

Q Yes?

A And it is related, of course, to the - again, it is built around the assumption of the open potential and what the potential will be and the slope of the production.

Q I noticed that for some of the fields in your tabulation, there are, that is in your tabulation in J-33, there are no deliverability schedules in Exhibit 35. What does that mean, Mr. Galloway? I have in mind Jumping Pound for example?

A Well, Mr. Jenkins simply did not prepare this, but only prepared it for Southern Alberta. Now, I neglected to ask him when I talked to him why he did so, but I did notice, of course, that he had prepared it for just those fields rather than take the other fields which are tied into the system.



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MR. S. N. SMITH: May I point out, Dr. Govier, that he does discuss that briefly at the top of page 2.

Q DR. GOVIER: Mr. Galloway, at the top of Page 2 there is a paragraph discussing Jumping Pound, and one of the sentences in this paragraph is to the effect,-

"This figure discounted for a recoverability of 75% with 7.1% inerts and an abandoning reservoir pressure of 400 p.s.i.a. gives an estimated marketable volume of gas of 447 billion cubic feet."

Has that anything to do with the deliverability from Jumping Pound, Mr. Galloway?

A No, that merely is the estimate of the reserves.

Q That is a recapitulation of the statement on your Table, is that right?

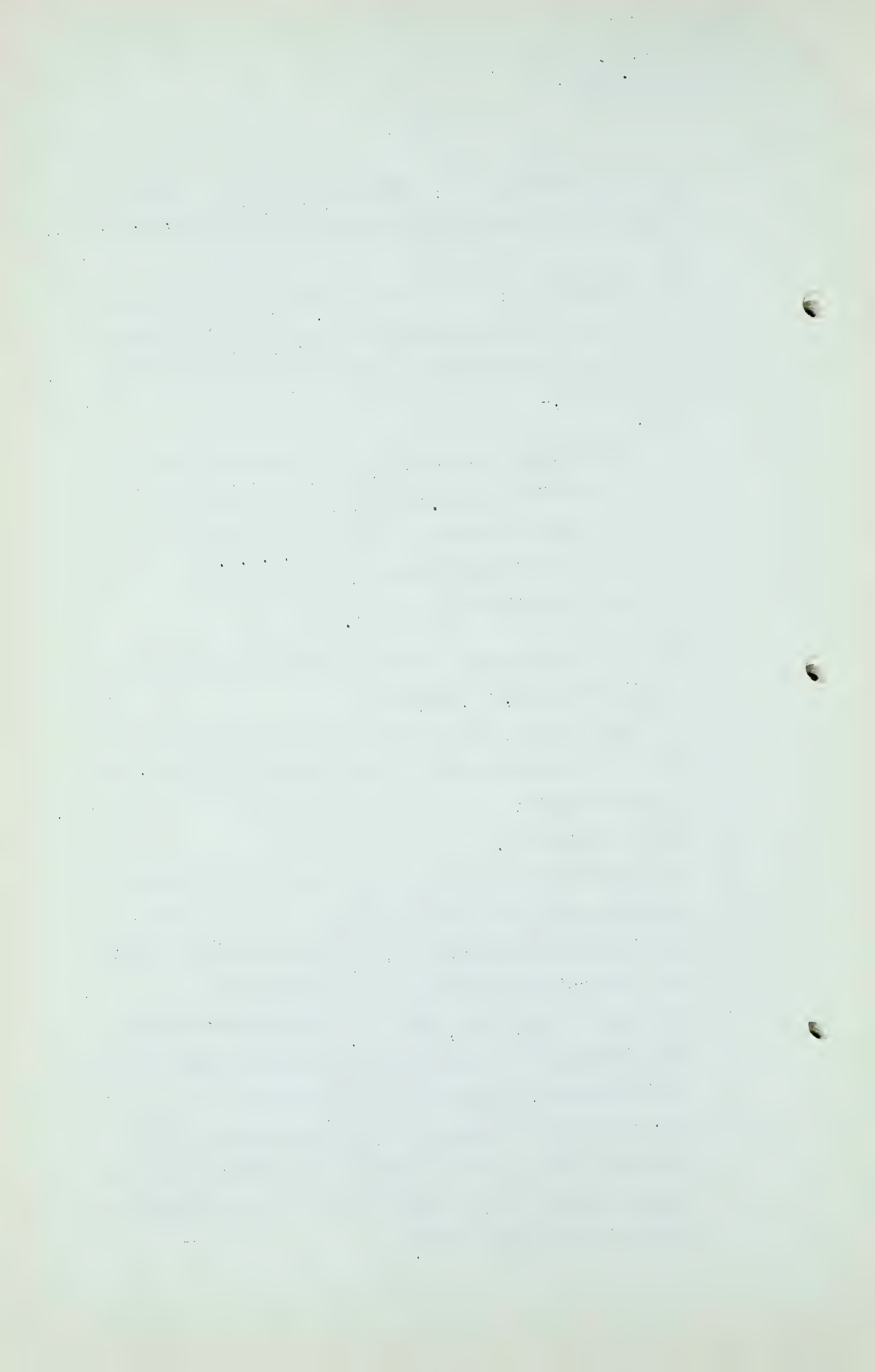
A That is correct.

Q So that there is no data in this exhibit that deals with what you would call deliverability at Jumping Pound?

A There is no data which deals with either Jumping Pound, the Leduc-Woodbend gas cap or Turner Valley.

Q It rather looks, then, that Mr. Jenkins has confined his attention to those fields from which Prairie might be drawing gas, is that a fair inference?

A Yes, I think that might be a fair inference, or it might be that he did not consider that there would be any gas permitted for export from the fields which are already tied to the system.



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Q To your knowledge, has Mr. Jenkins, or has anyone else for Prairie, prepared any other sort of deliverability schedule which might show how the Provincial requirements could be met from gas in the Province?

A There are none, so far as I know.

Q Thank you, Mr. Galloway.

MR. GOODALL:

Q Mr. Galloway, I would like to take you back to your submission, Exhibit 33. I was rather interested in your map on the Princess-Brooks area. I find in there that there is rather a long extension of the producing area running southeast in which there does not seem to be any wells drilled. Is that information taken from seismic data?

A No, it was taken from a study of structural elevation of the Madison limestone or the Rundle, if you prefer to call it that, in that area, and on a map which I have prepared on a large scale, I did not show those contours in any area other than that shown to the north.

Q Your control then, for this area, is the contours of the Rundle?

A That is correct. It is the contour of the Rundle, and, as a matter of fact, this bonnet, if you want to call it that, that is looking to the southeast on the map of the Princess area, actually lies in a low structural area, and along the northeast flank of that low structural area, so that the contours actually begin at, as shown, in the northwest corner of Section 17, Township 19, Range 13, near that gas well, the contours show near the gas well to the southeast, and it would roughly

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parallel the dark line which I have shown in a bonnet-shape southeeast of that well.

Q And you would have to assume, of course, your sand thickness in that area?

A I would have to assume my sand thickness, but the data on the three wells which lie west of the well that I have just mentioned, show that the sand thickens up to, as I recall, 80 feet in the centre well, and then thins out to 10 or 15 feet in the well farther west, so that there is a large sink in which these Lower Cretaceous sediments have been deposited, and I would have to project from the thickness in the wells which lie to the south of the bonnet and to the northeast of the bonnet, I would have to project the thickness to show that bonnet.

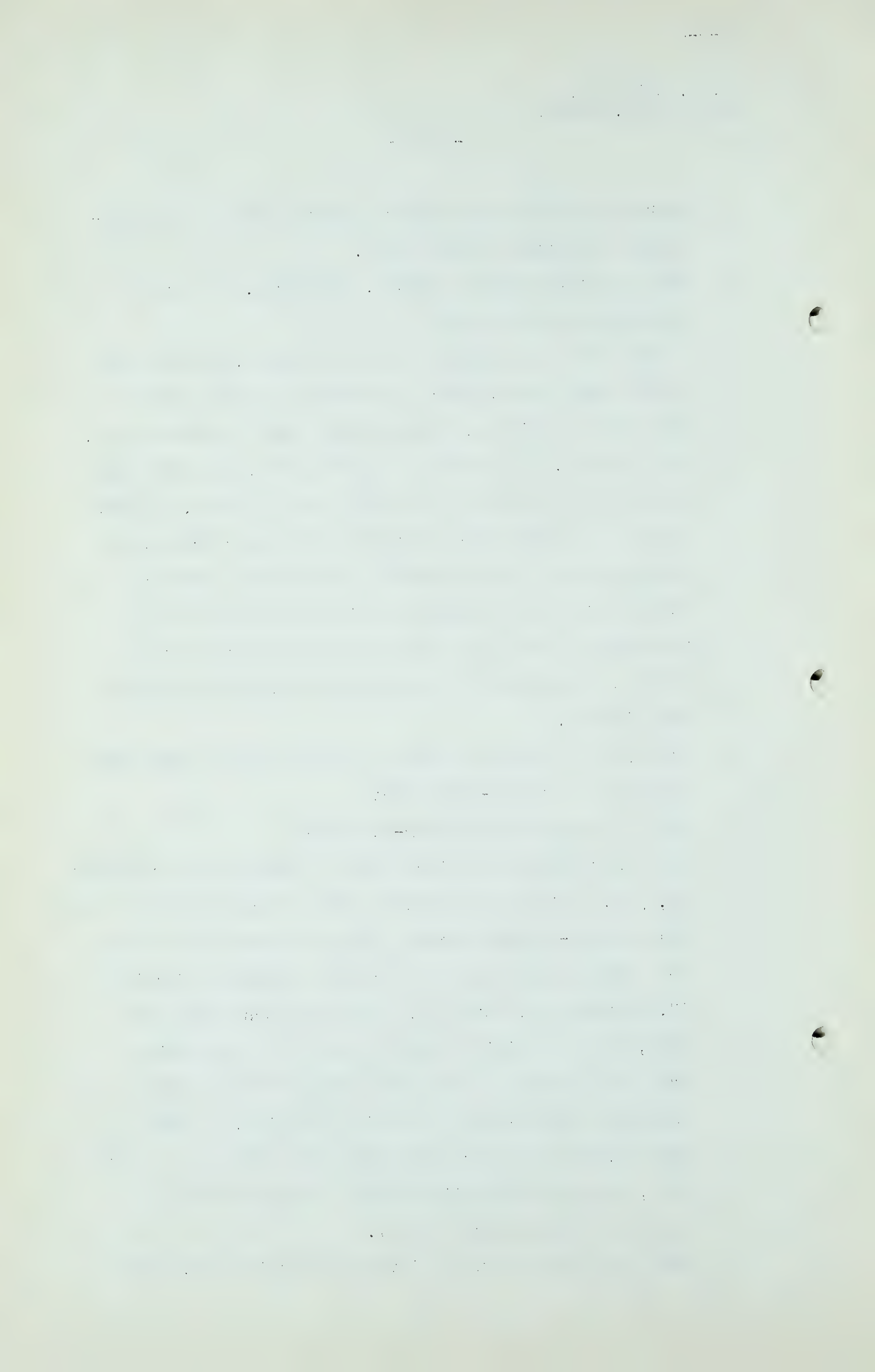
Q Have you any reason to think that the sand in that sink might not be water-saturated?

A That it might not be water-saturated?

Q Yes? Any reason to believe that it should be a gas sand?

A Oh, yes, I think it is likely that a large portion of that will be gas-bearing because the well which I referred to a moment ago is in the northwest corner of Section 17, Township 19, Range 13, that is a substantial gas well, and the opinion which I was able to determine from other wells to the north and northeast is that the water level is at a certain elevation, so that I may project the water level along the contour as I have done, near the gas well to which I have referred in the northwest corner of 17.

Q Have you found the water level to be uniform over the



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field where wells have been drilled?

- A I have, except in the area between the Princess field itself and the area immediately to the south. There the water level appears to cut across the contours. Now, the water level might cut across the contours in the area to which I referred today as a bonnet, but I recognize the possibility of the variation which might occur in the Sunburst zone in that area, and I applied to this area, which I have bordered in a heavy black line, a factor of 60% to cover such possibilities.

- Q I notice there are two abandoned wells in the area. Were they gas producers?

- A The gas well which has been abandoned, let us see, in the northwest corner of this heavy black area, and over along the east side of the heavy black area, there are two abandoned wells....

- Q Yes?

- Aand I recognize that the Sunburst may become quite impermeable, and, therefore, fail to give production, and that, again, is another reason why I have applied to the area the 60% factor in computing the productive acreage,

- Q 60% on the productive acreage?

- A 60% on the productive acreage, and then after that I applied a recovery factor.

- Q I think that is all I have, Mr. Galloway.

THE CHAIRMAN:

Thanks, Mr. Galloway.

.....

R. R. Herring,
Dir. Ex. by Mr. S. B. Smith

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ROBERT R. HERRING, having been
first duly sworn, testified as follows:-

MR. S. B. SMITH: I would like to tender, sir,
as an additional memorandum, a document prepared by
Mr. Herring, which, I believe, has been distributed to
everyone, and that is the memorandum, five pages in
length, entitled "A Submission to the Petroleum & Natural
Gas Conservation Board", dated October 30th, 1950. I
do not intend to read this memorandum, sirs, unless
someone desires to have it read. May I tender it?

THE CHAIRMAN: Yes, that will be J-36.

SUBMISSION TO THE PETROLEUM &
NATURAL GAS CONSERVATION BOARD
BY PRAIRIE COMPANIES DATED OCT-
OBER 30th, 1950, MARKED AS
EXHIBIT J-36.

MR. McDONALD: May I have some copies, Mr.
Smith?

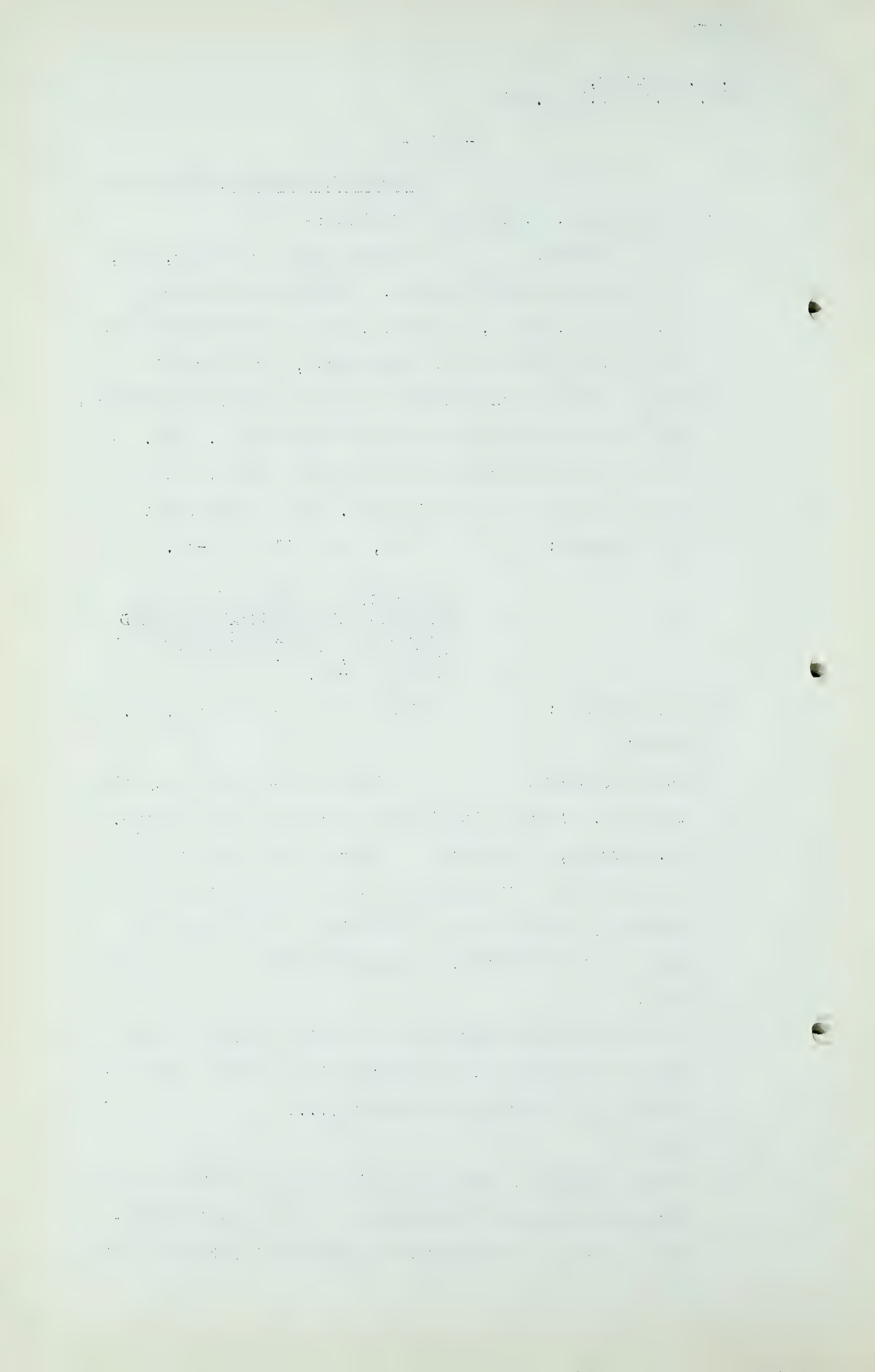
MR. S. B. SMITH: I think someone took away the
last one. I had a bundle here but they are all gone.

Q Mr. Herring, I would like to direct your attention to
the potential development of the gas resources of this
Province, particularly in relation to the proposed
plans of the two Prairie companies which you represent
here.

A In discussing the position of our two companies with
respect to reserves, and deliverability of the gas res-
erves of the Province of Alberta.....

Q Yes?

A We are bearing in mind the requirements of the Federal
Power Commission in Washington as to the deliverabil-
ity of gas to be dedicated to any market intended to be



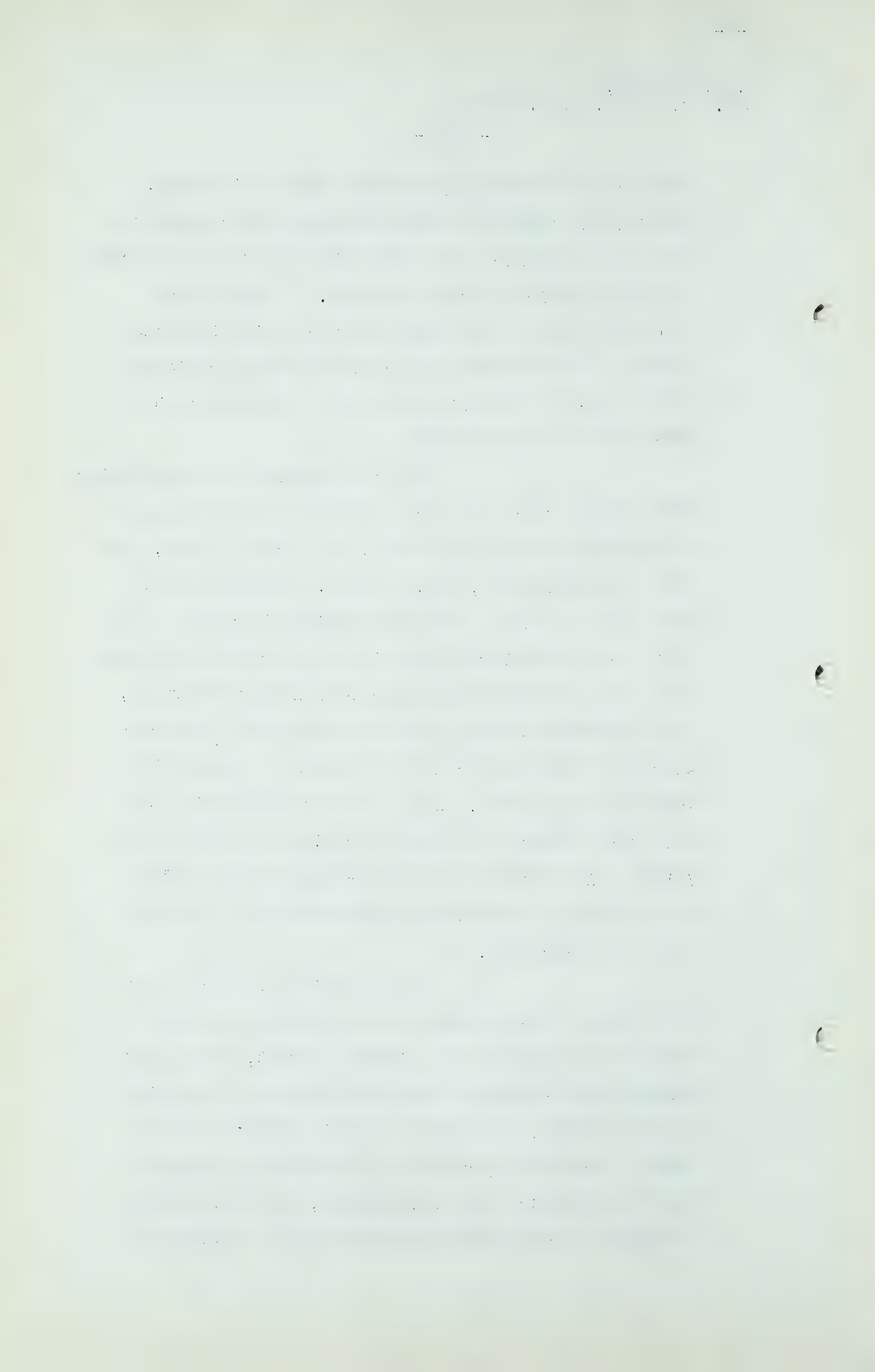
R. R. Herring,
Dir. Ex. by Mr. S. B. Smith

- 872 -

served by the various applicants before this Board, that is, the status of deliverability with respect to those reserves which they will make use of in the services or in the service of those markets. All of the applicants before this Board are faced with the same problem in establishing the deliverability sufficient for 20 years of servicing any market intended to be served in the United States.

Our two companies in considering this problem feel that such reserves as are in excess of Provincial requirements are, to a great extent, far from being developed, and, as such, would require a great deal of time. We are as optimistic as all of the engineers and geologists who have appeared on the stand have been as to what may develop in Alberta Province, and we realize the very great problem before the Conservation Board in deciding the amount of exportable surplus at this time. And in that consideration we have filed before this Board our plan for export from Alberta. And I would like to re-emphasize that plan in the light of reserves and deliverability as they have been discussed.

In our opinion, there is one way in which Pincher Creek can be developed and made available to Calgary to a limited extent, and we have proposed such an export which would make that possible. In other words, our company in this submission will agree to construct, subject to a workable agreement with the Canadian Gulf Oil Company, a gasoline plant at Pincher Creek capable of putting out a stream of



R. R. Herring,
Dir. Ex. by Mr. S. B. Smith

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pipe line gas in the volume of 150 million cubic feet of gas per day, and we would make 50 million cubic feet of that gas daily available to the system of Canadian Western at Calgary.

Now, the map submitted with this brief shows a line which comes into the Canadian Western system below Calgary. It is probable that such a line would have to be constructed directly into Calgary to furnish the full benefit of the deliverability of that 50 million cubic feet daily to the Canadian Western system.

Q You mean directly from Pincher Creek to Calgary?

A Directly from Pincher Creek to Calgary.

Q Yes?

A When that volume is not required, and in accepting Mr. Davis's estimates as to the requirements of the local utilities, and we do so realizing that his is one of the finest reputations in the United States in natural gas today, we feel that the 50 million cubic feet of gas daily will materially meet the requirements which Mr. Davis has laid out for the Canadian Western system over the next 20-year period, but, that, as he stated, this demand would not be made upon Pincher Creek for probably eight to ten years.

Now, our proposal would be that, at the direction of the Board, such a line would be constructed when actually required, and until that time the 50 million cubic feet of gas daily would be held in reserve in Pincher Creek, in that light we have

R. R. Herring,
Dir.Ex. by Mr. S. B. Smith

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listed each of the engineers who have appeared before the Board and their estimates on the marketable gas reserves of Pincher Creek.

In studying the problem to be met by each of the exporting companies, which is, likewise, a serious problem, along with that of the Board, we feel that the proposal of our companies in dedicating this volume of gas, which has a small initial export volume to ~~British~~ Columbia, that it can be supported merely by financial testimony before the Federal Power Commission and will not require detailed deliverability.

If a market is to be served in the United States with a full volume of Alberta gas, it must be deliverable. I think anyone that is familiar with Federal Power Commission testimony will support that statement. We have sought to arrive at a solution to the initial exporting problem before the Board, and we feel that this presents a sound initial method of exporting the natural gas which will give the impetus to the drilling of wells in the Province which the Board desires to achieve, and in recognizing the statements of Imperial, and other oil companies, when they state that they will not invest additional capital until a market is available for the gas that they have or will develop. That is the attitude of our company, and we make these statements relative to Pincher Creek because we feel that Pincher Creek, with regard to the export development, due to the high cost of wells and the extreme cost of a gasoline plant, needs a constant flow such as could be provided by our program, and that

R. R. Herring,
Dir. Ex. by Mr. S. B. Smith

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such a program is not in sight within the foreseeable future in the Province, and in doing so we will make the volume available to the Canadian Western system as we have outlined.

I think that covers, generally, our submission. I would like to point out just one additional thing to the Board, that even this 100 million cubic feet per day, and the system coupled with it, when considered with the development in Pincher Creek, and the gasoline plant, would involve over the next 20-year period an expenditure of our company, having regard to the separation gas produced, and so forth, approximately 120 million dollars during this 20-year period.

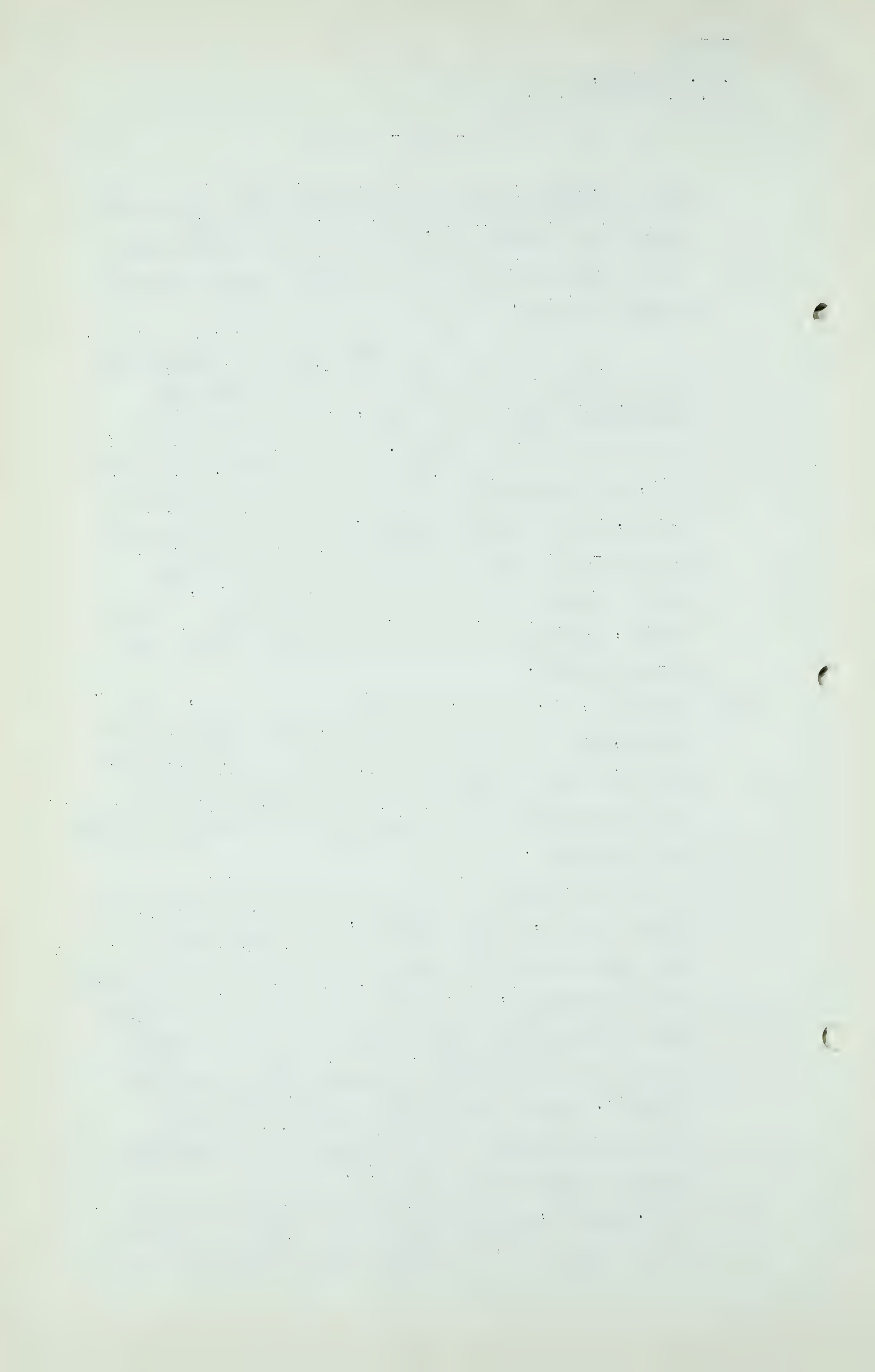
Q And that, Mr. Herring, is taking into account, I understand, only the development at Pincher Creek itself and the pipe line from Pincher Creek in the direction of the International boundary and in the direction of Calgary?

A That is right.

Q You are not taking into account other developments in the Province, in other fields, which might follow on the construction of an export line in giving that figure?

A That is correct, sir. And in that light, on the Gulf Coast today the development of the gas is more avidly sought by the various oil and gas companies than that of oil. The gas development program in the Gulf Coast region amounts as much financially to the State of Texas today as that of oil.

Q Mr. Herring, would you care to say a word as to what, in your opinion, the development of the gas reserves



R. R. Herring,
Dir.Ex. by Mr. S. B. Smith

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of this Province might mean to this Province from an economic point of view.

A I think with the proper impetus of an export line, that it will lend the same benefit to the Province in the form of gas exploration and development which it now has gained from the exploration and drilling for oil.

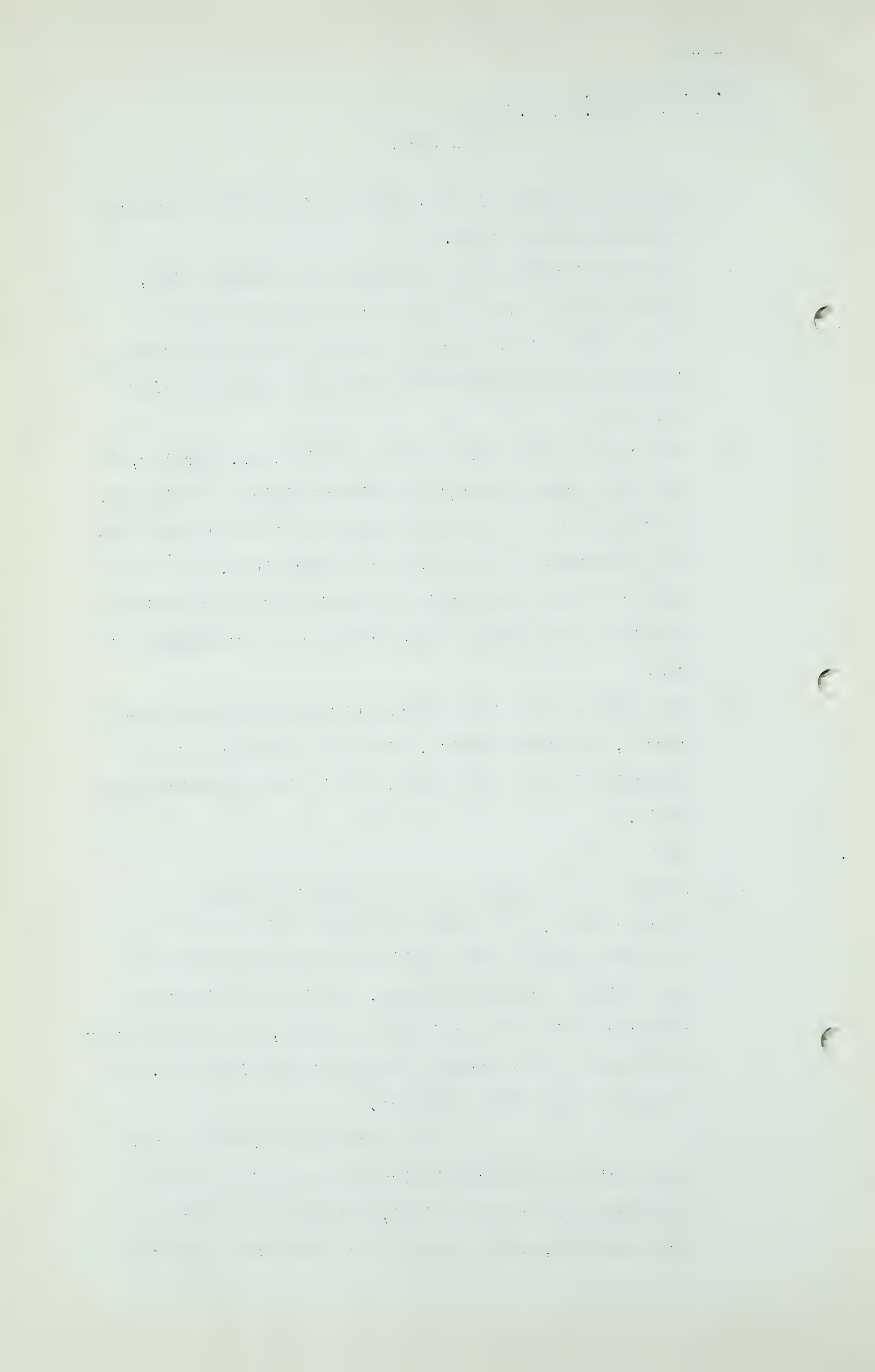
Q The reason that I asked that question, Mr. Herring, is that the ordinary man, the ordinary citizen of Alberta, seems to have a keen appreciation of the benefits that the production of oil has for the Province, but there appears to be very little discussion of the potential benefits gained by the exploration and development of gas?

A The exploration of the Texas Gulf Coast has only occurred, and the benefits, with the entrance of the exporting lines to the east, and it is a relatively new field.

Q Yes?

A I would like to say one other thing in respect to Pincher Creek. The gasoline plant development on the basis which I have outlined in the submission is not a highly economic project. It is economic when considered with the project as a whole, and when amortized over the full 20-year period of our pipe line, and as part of the entire project.

The statements made by Gulf on the stand yesterday indicated the desire to stay away from a processing plant, I believe I interpreted that properly, and it seems to me they would welcome



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a workable arrangement in which the facilities would be amortized as a part of the rate base of an export line.

Q Do you wish to say anything at all about the subject which Mr. Davis discussed, namely, the possibility of the development of Pincher Creek as a portion of the Canadian Western system?

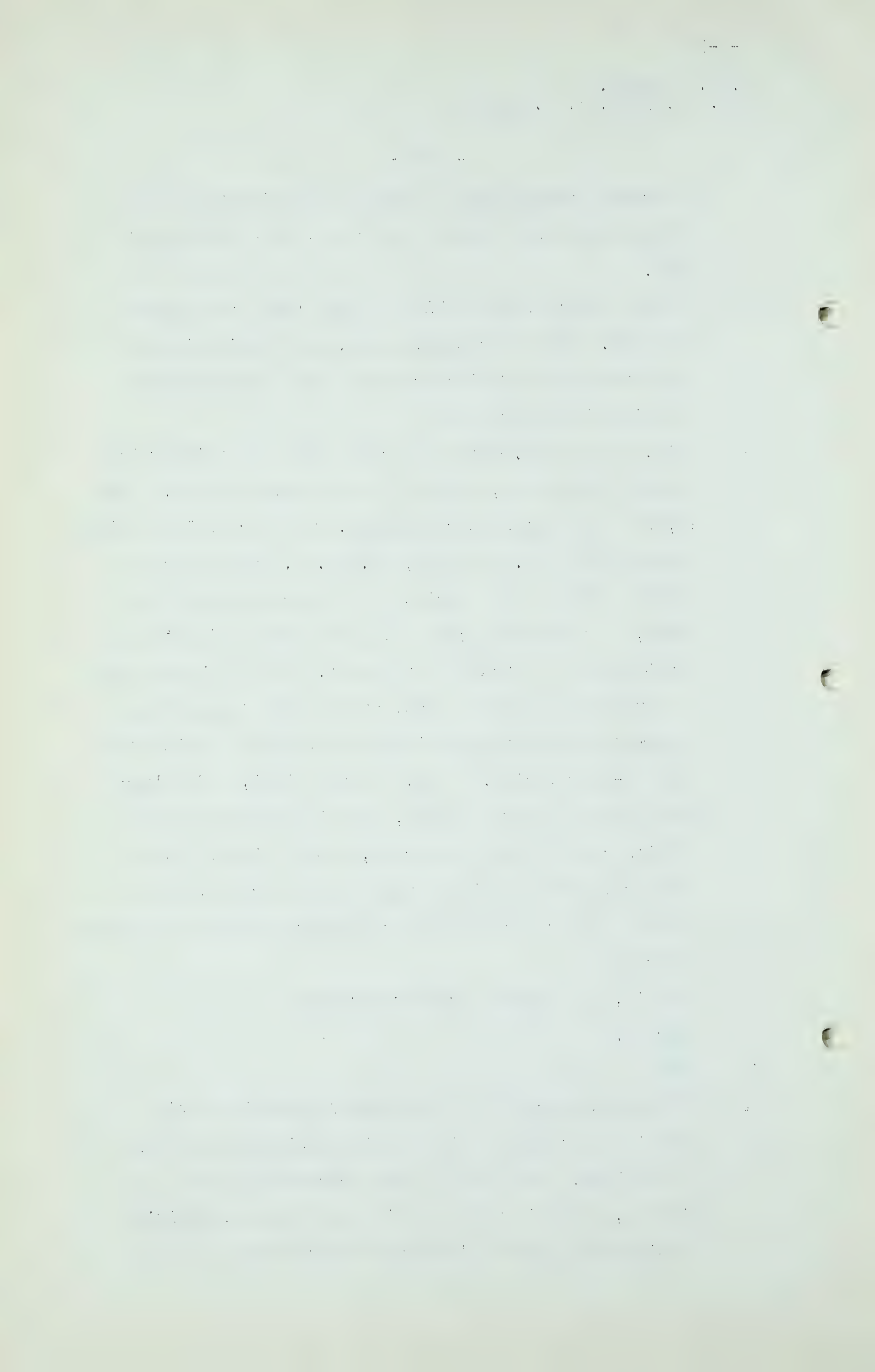
A Well, I think Mr. Davis made clear the same point which I have just stated, that in a field such as that, with 12,500 foot depths approximately, with each well costing between \$800,000.00 and \$1,000,000.00, that a large stream over the full period of a contract such as 20 years, is absolutely vital over the full period to the amortization of such an investment, and that it can only be developed by such a load, and in that light I see no such load development within the Province during the next 20-year period. Now, in that light, a development such as we have in mind, and figuring some 1200 billion cubic feet of reserves, in that field, and we have previously testified here that we are able to finance our project on the present proved nature of those reserves.

Q That is, the Pincher Creek reserves?

A Correct.

Q Yes?

A We would withdraw on a net basis 730 billion cubic feet in supplying the 100 million cubic feet per day to our line. That would leave approximately 500 billion, which is very much in line with Mr. Davis's requirements for the Canadian Western system to be



R. R. Herring,
Dir.Ex. by Mr. S. B. Smith

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delivered or made available on the terms which I have outlined.

Q Yes, and when you made your plans, of course, you had no knowledge of what Mr. Davis's evidence was going to be before this tribunal?

A Not at all. It is a very logical development, I feel, and it would allow export to begin with a small initial volume, which is the very basis of our presentation before the Board, and that our deliverable reserves which would meet the requirements of the American, the U. S. Part of the Pacific Northwest market, would be delivered from Texas. Some discussion has come out about our deliveries from Texas. I would emphasize with regard to that that deliveries would be made all the way up the line from the Texas line at all points en route to the Pacific Northwest. We cover quite a wide market in that route.

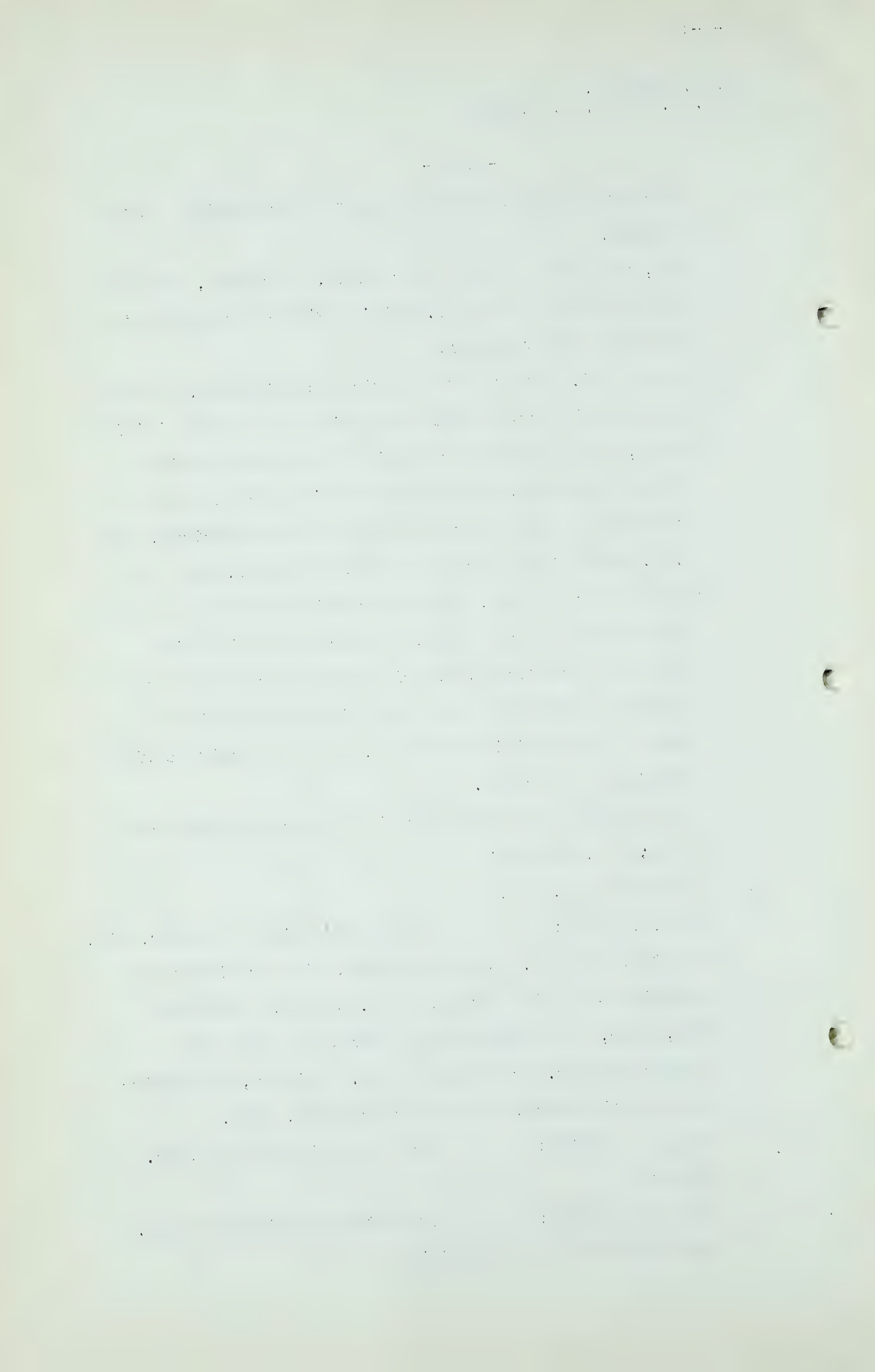
Q Do you wish to add anything else to what you have had to say, Mr. Herring?

A I believe not, sir.

MR. S. B. SMITH: I would now like to tender, sir, a letter from Mr. Rush Greenslade, Vice-President of Canadian Gulf Oil Company, to Mr. Wilton, dated May 29th, 1950, with which he has enclosed a copy of a letter from Mr. Greenslade to Mr. McKinnon, the Chairman of this Board, dated February 20th, 1950.

MR. C. E. SMITH: What does it deal with, Mr. Smith?

MR. S. B. SMITH: It deals with Pincher Creek. Would you like me to read it?



R.R. Herring,
Dir. Ex.by Mr. S. B.Smith

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MR. C. E. SMITH: No, I just am wondering what the significance of that is here at all. It might be a letter from the Prince of Wales.

MR. S. B. SMITH: Well, perhaps if I read it to you, read to you the first paragraph, it might indicate that it is not a letter from the Prince of Wales. It is dealing with something a little more serious.

MR. C. E. SMITH: That is what I want to know.

MR.S. B. SMITH: May I read part of the letter?

MR. C. E. SMITH: Go ahead and read it.

MR.S. B. SMITH: All right. I have your permission to read it, sir?

THE CHAIRMAN: Yes.

MR. S. B. SMITH:

"Dear Mr. McKinnon:

As requested in your letter of February 1, enclosed for your confidential information is a reservoir study of the Pincher Creek Field, Alberta, Canada, which reviews"....

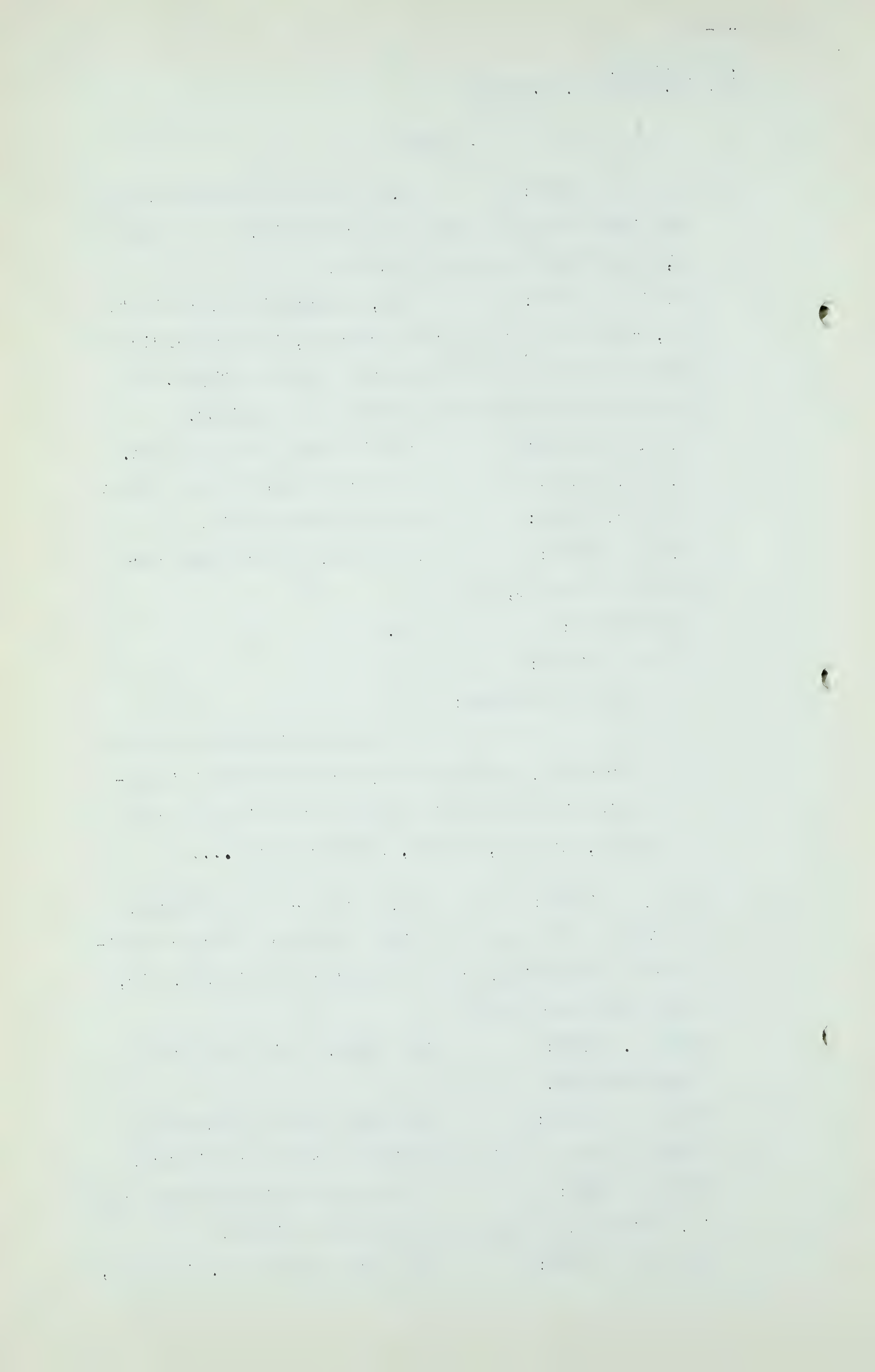
MR. C. E. SMITH: Now, surely - just a minute, Mr. Smith. You start off with "enclosed for your confidential information," and it is addressed to you, sir, I hope you heard that?

MR.S. B. SMITH: All right, I will go back a little farther.

MR. C. E. SMITH: Probably the Chairman would like to know if it is something he got in confidence.

MR.S.B. SMITH: I think the Chairman knows about it. If you will just let me go for a minute.

MR. C. E. SMITH: You have got that in. Go ahead,



R. R. Herring,
Dir.Ex. by Mr. S. B. Smith

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I am sorry.

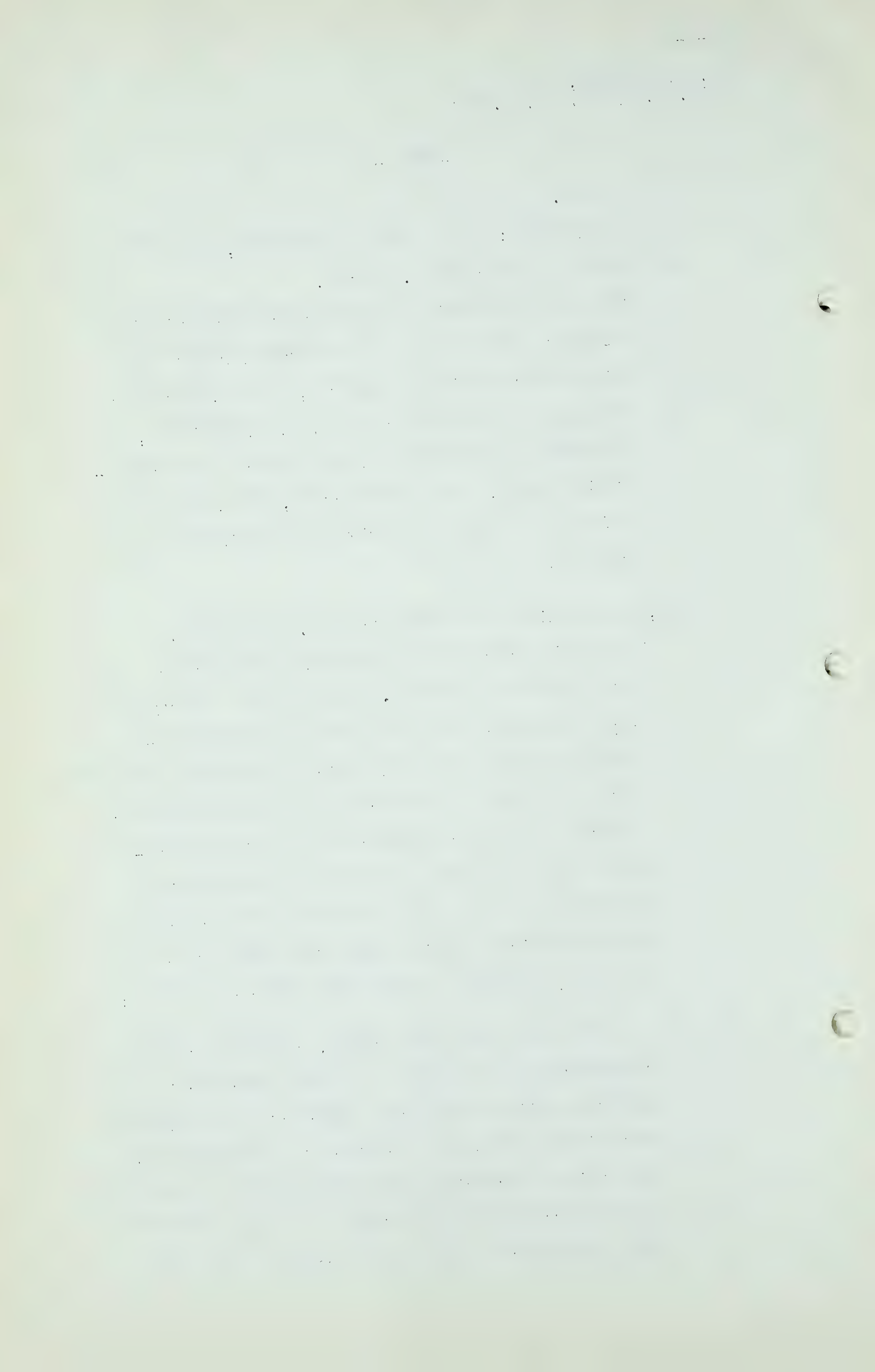
MR. S. B. SMITH: This is what Mr. Greenslade
says in the letter to Mr. Wilton.

"For the information of the Prairie Transmission Company I enclose copy of reservoir study of the Pincher Creek field, Alberta, Canada, together with copy of my letter to Mr. I. N. McKinnon, Chairman of the Petroleum and Natural Gas Conservation Board, dated February 20, 1950, both of which Mr. McKinnon has given us permission to release."

Now, I go on with the letter from Mr. Greenslade.

"It may be appropriate for us to state further that Canadian Gulf Oil Company is not a party to any proceeding before The Petroleum and Natural Gas Conservation Board in which applications have been made for license to export gas from the Province; nevertheless, since during such hearings statements have been made concerning the production and possible sale of gas from the Pincher Creek Field in which Canadian Gulf Oil Company is an operator, we wish to advise the Board as follows:

Canadian Gulf Oil Company, conscious of its responsibilities as an oil and gas operator in Alberta, believes that the exportation and sale of natural gas out of the Province is necessary for the full and orderly development of the oil and gas resources of the Province. It also believes that the gas reserves of the Province have been



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R. R. Herring,
Dir. Ex. by Mr. S. B. Smith

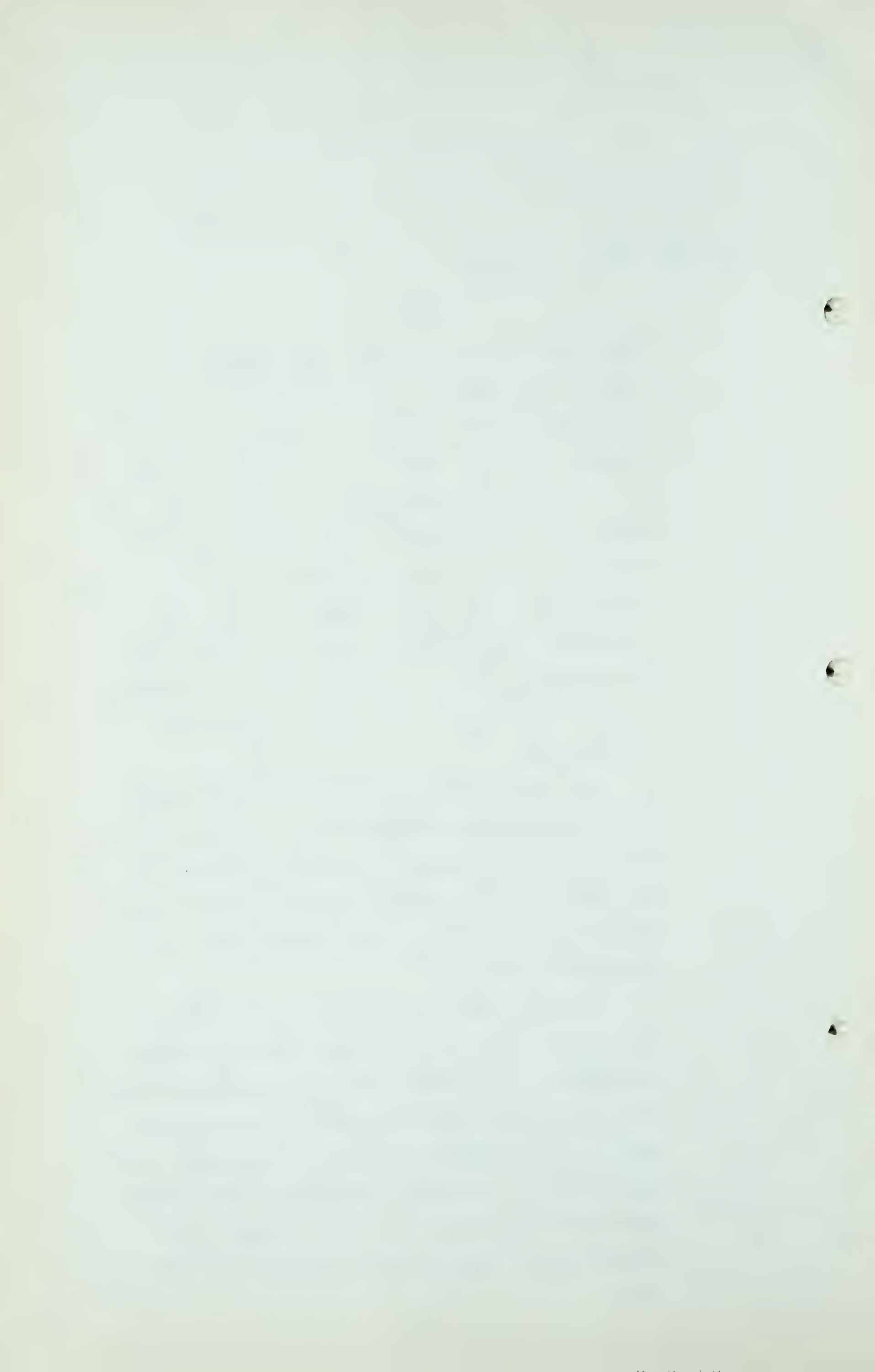
- 881 -

"developed to the point that the long-term needs of the Province may be met and the surplus above these needs exported. Therefore, and without injecting itself into the deliberations of the Board, Canadian Gulf Oil Company feels that the best interests of the Province, as well as those of the oil and gas operators, will be served by the granting of export licenses. The Board will decide applications for export licenses on their merits and Canadian Gulf Oil Company does not intervene in any case of conflicting applications.

As a producer in the Pincher Creek Field we have furnished and will furnish all available data to the Board to enable it to make an estimate of gas reserves in that field and to promulgate such operating regulations as are consonant with sound engineering practice.

Canadian Gulf Oil Company has not contracted with anyone for the sale of gas from the Pincher Creek Field, but stands ready to negotiate for the sale of such gas with any person of demonstrated ability to transport and market such gas, who complies with the necessary Governmental requirements and who offers prices and related terms satisfactory to the Company for the purchase of such gas."

I will hand that in, sir.



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R. R. Herring;
Dir.Ex. by Mr. S. B. Smith

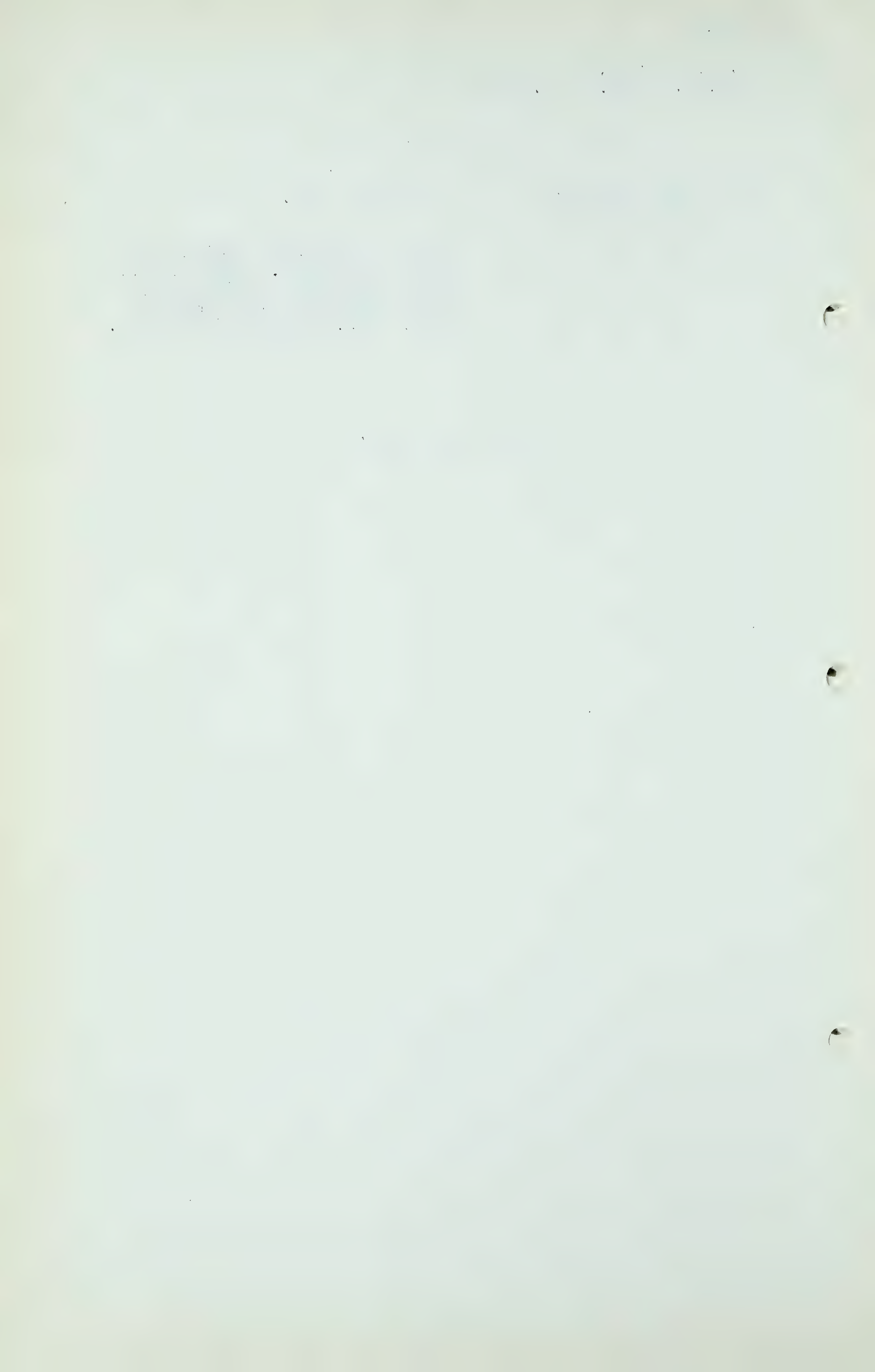
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THE CHAIRMAN:

Exhibit J-37.

LETTER FROM RUSH GREENSLADE TO
MR. G. M. WILTON, DATED MAY 29,
1950, ENCLOSING LETTER TO MR.
I. N. McKINNON DATED FEBRUARY
20th, 1950, MARKED EXHIBIT J-37.

(Go to Page 883).



R. Herring,
Exam. by Mr. S. B. Smith.
Cr. Ex. by Mr. Nolan.

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Q Mr. Herring, one other subject I would like to ask you about. You have, I believe, had negotiations with respect to the purchase of supplies of steel for the construction of the pipe line?

A We have signed contracts with the Consolidated Western Steel Corporation and the Kaiser Steel Corporation for the entire steel requirements, both plate and pipe for the construction, or necessary for the construction, rather, of our project. The delivery requirements, as stated in these contracts, starts next April and is completed in August 1952.

Q And these documents I have in my hand are photostatic copies of the contracts between the Kaiser Steel Corporation, General offices 24 Broadway, Oakland 21, California and one with Consolidated Western Steel Corporation, a United States Steel corporation subsidiary. These are correct photostatic copies of the original contracts that are held in your office?

A They are. I might add that they are only subject to the permit from the Federal Power Commission as to our application for a certificate of convenience and necessity. That is the only condition of the contract.

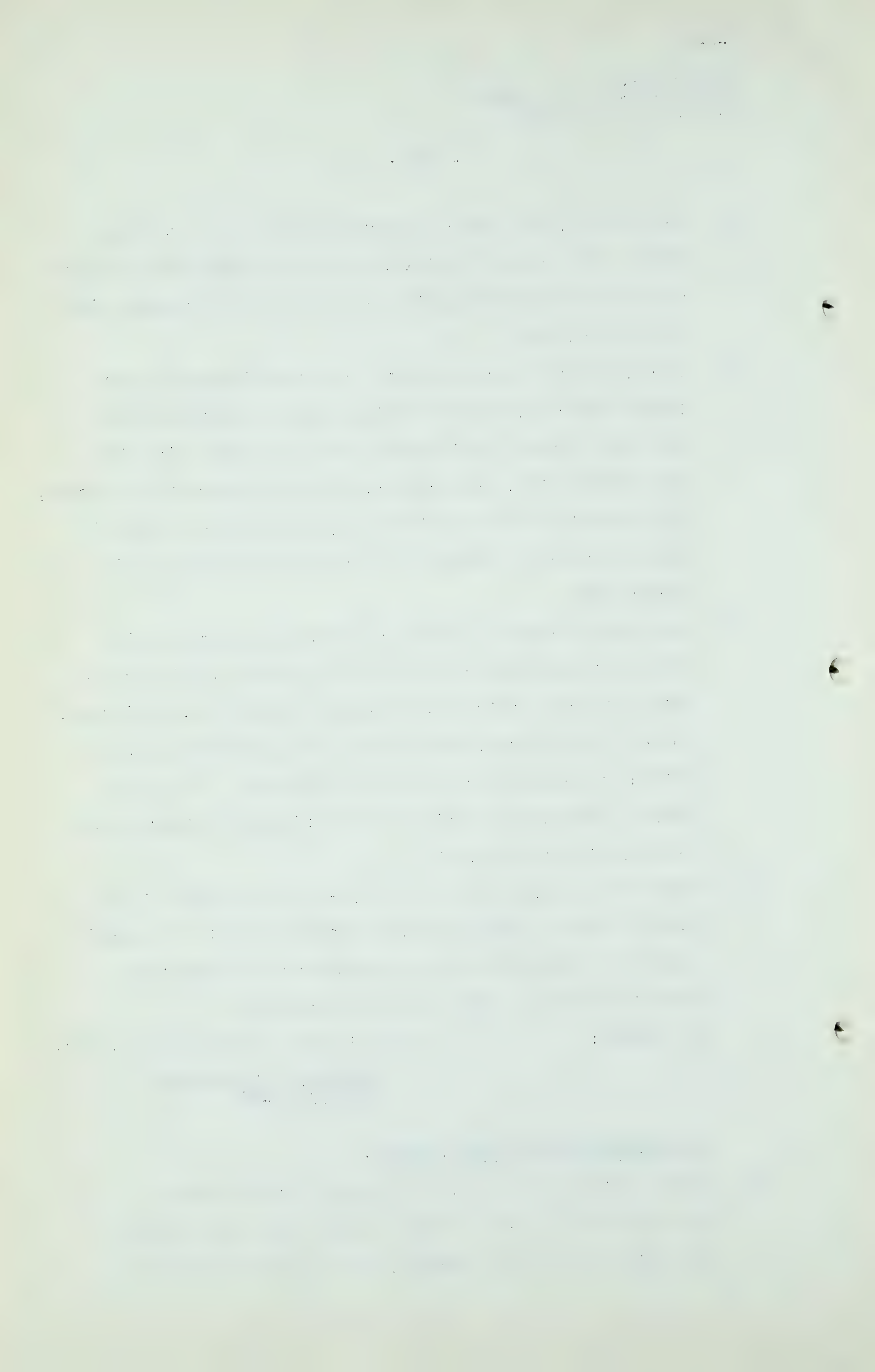
MR. SMITH:

I would like to tender these, sir.

DOCUMENTS NOW MARKED
EXHIBIT J-38.

CROSS-EXAMINATION BY MR. NOLAN:

Q I was going to ask you, Mr. Herring, in the plan or map attached to J-36 I noticed that there is a proposed gas pipe line between Calgary and Red Deer indicated by



R. Herring,
Cr. Ex. by Mr. Nolan.

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a dotted line?

A Yes, sir.

Q What is the contemplated size of that line?

A We suggested that possibly an extension, realizing that the present pipe line down from the Northwestern Utilities system is very small and as the possibility of including some peaking gas from Pincher Creek into that system, it is very possible that Northwestern Utilities might require to do a certain amount of looping to take any advantage of this peaking supply. What we have in mind was that not only Bow Island but Pincher Creek and there should be built up a surplus in this southern end of the province and that some of that should be made available to the north and it might assist the Northwestern Company. In addition it might also supply additional communities en route. We have made all of these dotted lines with the exception of the Prairie application and the proposed line from Pincher Creek into Calgary merely is our suggestion of the means of extending the present system in the most economic manner and to keep the consumer cost of gas in Alberta at approximately its present level, if possible.

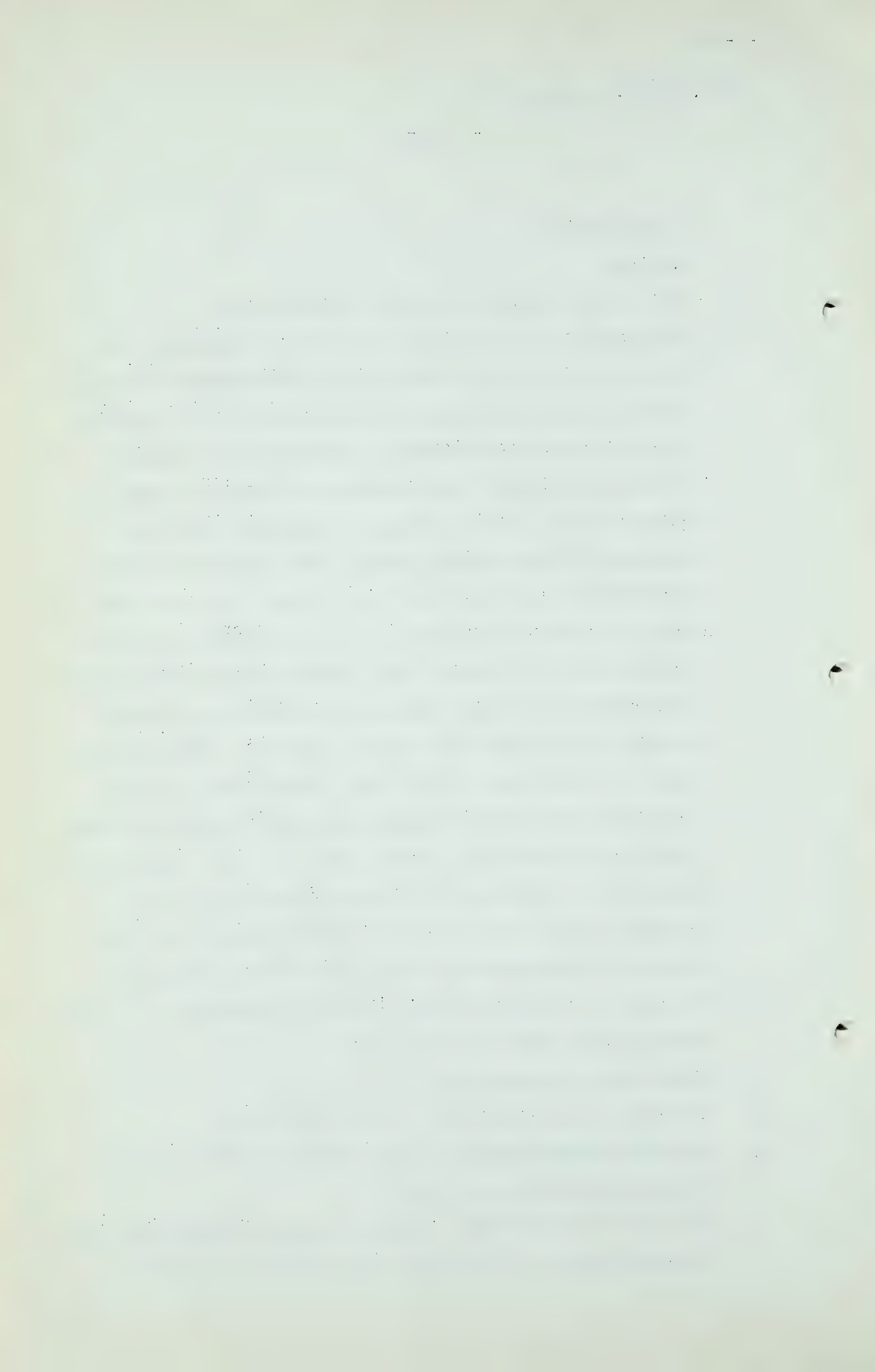
Q The present consumer system is the Northwestern Utilities running from Camrose to Red Deer?

A That is my understanding.

Q And what is the capacity or size of that line?

A It is my understanding it is 6 inch at the present time.
I may be misinformed on that.

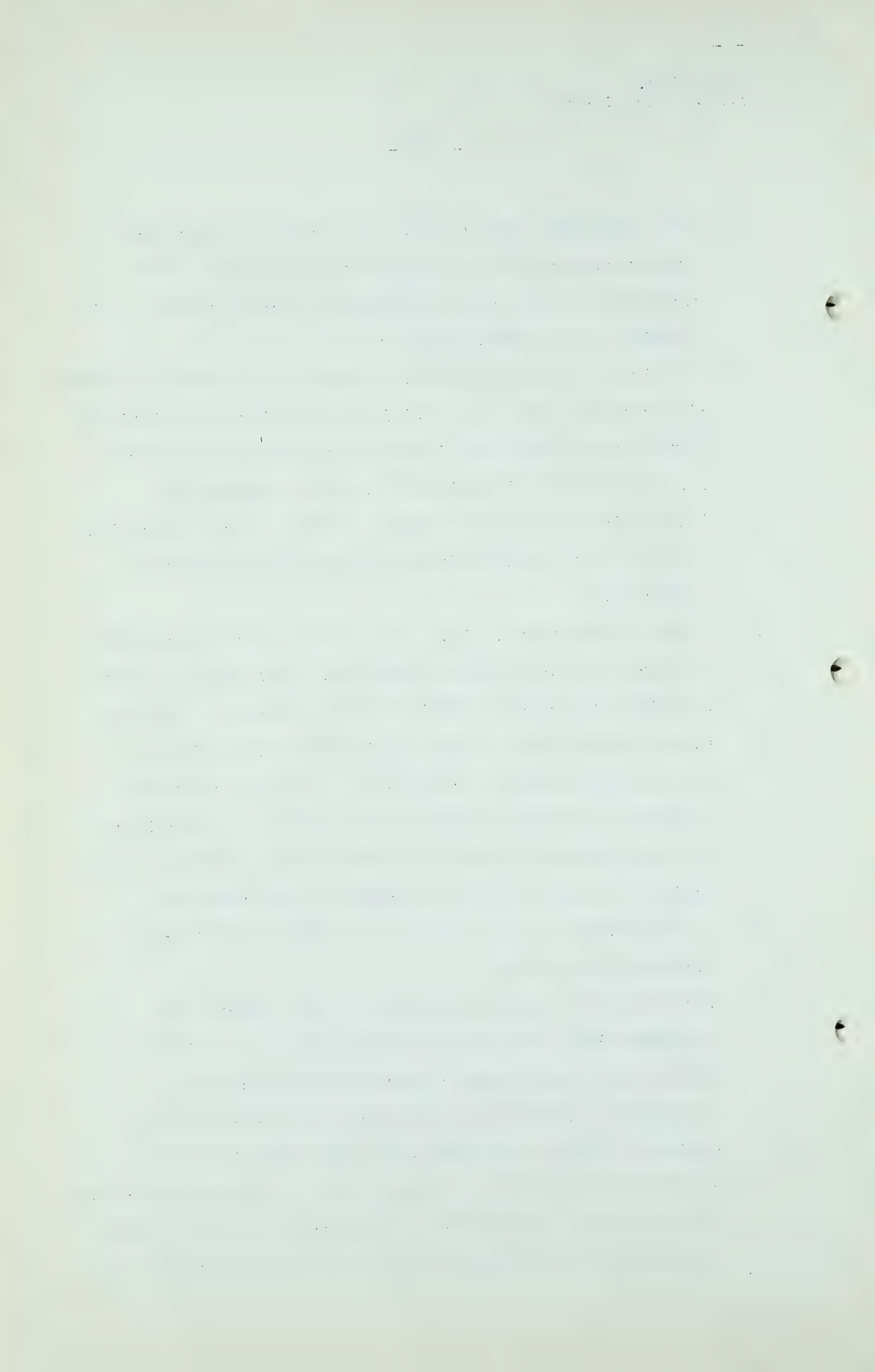
Q And does it follow that the size of your proposed gas line between Calgary and Red Deer will also be six inches?



R. Herring,
Cr.Ex.by Mr. Nolan.

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- A No. My effort there would be to decide just how much peaking requirements we might have and build a line requisite to meet that requirement and which would be of benefit to the Northwestern system.
- Q The size of your proposed line between Red Deer and Calgary will depend upon the possibility of looping the existing Northwestern Utilities line running north of Red Deer?
- A I see benefits to be gained by such an extension.
- Q I was going to ask you one more thing. Is the allocation of steel in the United States now under Governmental authority?
- A Only to this extent, sir, they are now established under the power of our Defence department, and subject to what we call D.O. orders, that is Defence Orders. Those can take priority but we have been in close discussion of our problems with Mr. McHugh who is the new Government director of steel allocation and he said, he assured us of the possibility that the contract will stand up if our project is approved by the Federal Power Commission.
- Q And provided for the purposes of defence steel is not required elsewhere.
- A Surely. But I might point out in that respect the Tennessee Gas during the last war, serving a similar purpose to our proposed project, was ordered by the executive department of our government to build that project and the steel was taken away from ships to so construct such a line. I would like to refer also on this point to the consideration of the letter which Mr. Howe addressed to Mr. Tanner and which was placed before the



R. Herring,
Cr. Ex. by Mr. Nolan.
Cr. Ex. by Mr. Martland.

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Board, which pointed out the very vital need of the Pacific Northwest for fuel. It is a present need and needs construction to begin as quickly as possible. In our opinion the deliberations of the Board, we have taken the responsibility of trying to establish a present exportable surplus of natural gas. In that light we have formed our application and in our minds, to comply with the best means of initiating gas export which the Province, in our mind has a surplus today. Now I think we have been very honest in our presentation and we have not changed it from the beginning. In that presentation we think Pincher Creek is the logical field in this idea which we have placed before the Board in the beginning of gas export from the Province.

Q MR. MARTLAND: I think Mr. Fish told us that his company was going to provide Pacific Northwest in any event, so far as the United States was concerned?

A Yes.

Q So that they would get their gas from Texas no matter what happened here?

A Provided the Federal Power Commission approves of our program.

Q Is Mr. Wilton named in the letter J-37 an officer of either of your companies, Mr. Herring?

A He is a director of the Prairie Company at the present time.

Q Where does he live?

A Toronto.

Q What is his business there?

A I believe he is a lawyer in Toronto.

R. Herring,
Cr. Ex. by Mr. Martland.

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MR. C. E. SMITH: That is an occupation.

MR. MARTLAND: Yes.

Q With reference to deliveries from Pincher Creek, Mr. Herring, it is not suggested that Canadian Western is going to require all these 50 million odd deliveries now, is it?

A No, I think I made that clear. We still agree with Mr. Davis as he outlined this entire program. We consider Mr. Davis' opinion very highly. We admit it would probably be 8 to 10 years before any such requirements would be necessary.

Q And what would happen to these 50 million odd in the meanwhile?

A It would be held in reserve.

Q With a plant with 150 million capacity?

A Yes.

Q How much would you be shipping out?

A 100 million of output gas a day.

Q And leave the other in reserve?

A Yes.

Q Now in the first paragraph in Item 1 of your submission you say, "The conclusions to be drawn from the submissions of the various engineers and geologists as to the proven natural gas reserves of Alberta and the availability of these reserves to the provincial markets of Alberta, and a possible export line, are considered by our company to require the entire dedication of all available fields to the local systems with the exception of Pincher Creek." Did you get that from Dr. Nauss and Dr. Hetherington? Did you have that view?

R. Herring,
Cr. Ex. by Mr. Martland.

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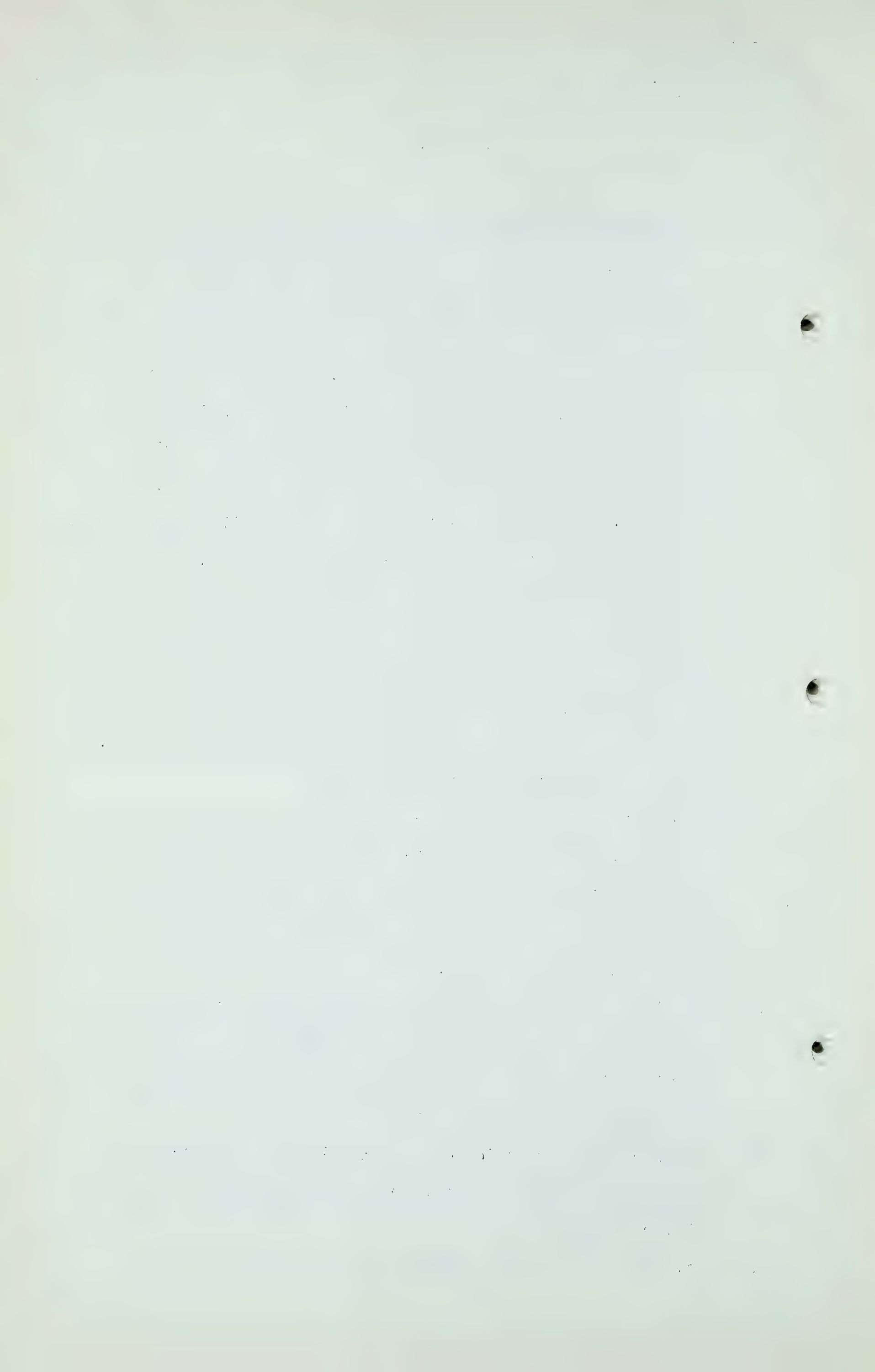
A I did not consider them as members of our company. This is the opinion of our company and after studying the reports of all the engineers and is based upon our idea of the actual proven reserves of the Province are those that are described by Mr. Galloway, in the area of the present systems. Now these outlying fields which are being drilled at the present time and new discoveries that are coming up subject to the drilling for oil, or rather are discoveries coincident to the drilling for oils, are not proven fields as our company sees them, because they are sometimes one well and sometimes three. There may well be a considerable volume of gas in those areas but what we would consider proven reserves today we feel are required - and I believe that same point was emphasized by Mr. Davis in his testimony - for these local systems. With the exception of Pincher Creek?

Q I take it that was the conclusion that you had reached on the basis of all the evidence of all the engineers and geologists. I take it Dr. Nauss and Dr. Hetherington are left out. Did you get it from what was said by Mr. Dixon and Dr. Brokaw?

A I think each of the geologists has tried to classify as proven and probable and I do not think the men that you mention will place a high degree of proven on certain of the fields which they list.

Q Have any of them said that there is to be an entire dedication of say the whole of the Pakowki Lake to the City of Calgary - -

A No, sir, that is the opinion of our company.



R. Herring,
Cr. Ex. by Mr. Martland.
Exam. by Mr. C. E. Smith.

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Q It is your own company?

A That is right.

Q By the way, what is the purpose of the proposed line connecting the Medicine Hat field with the Bow Island field?

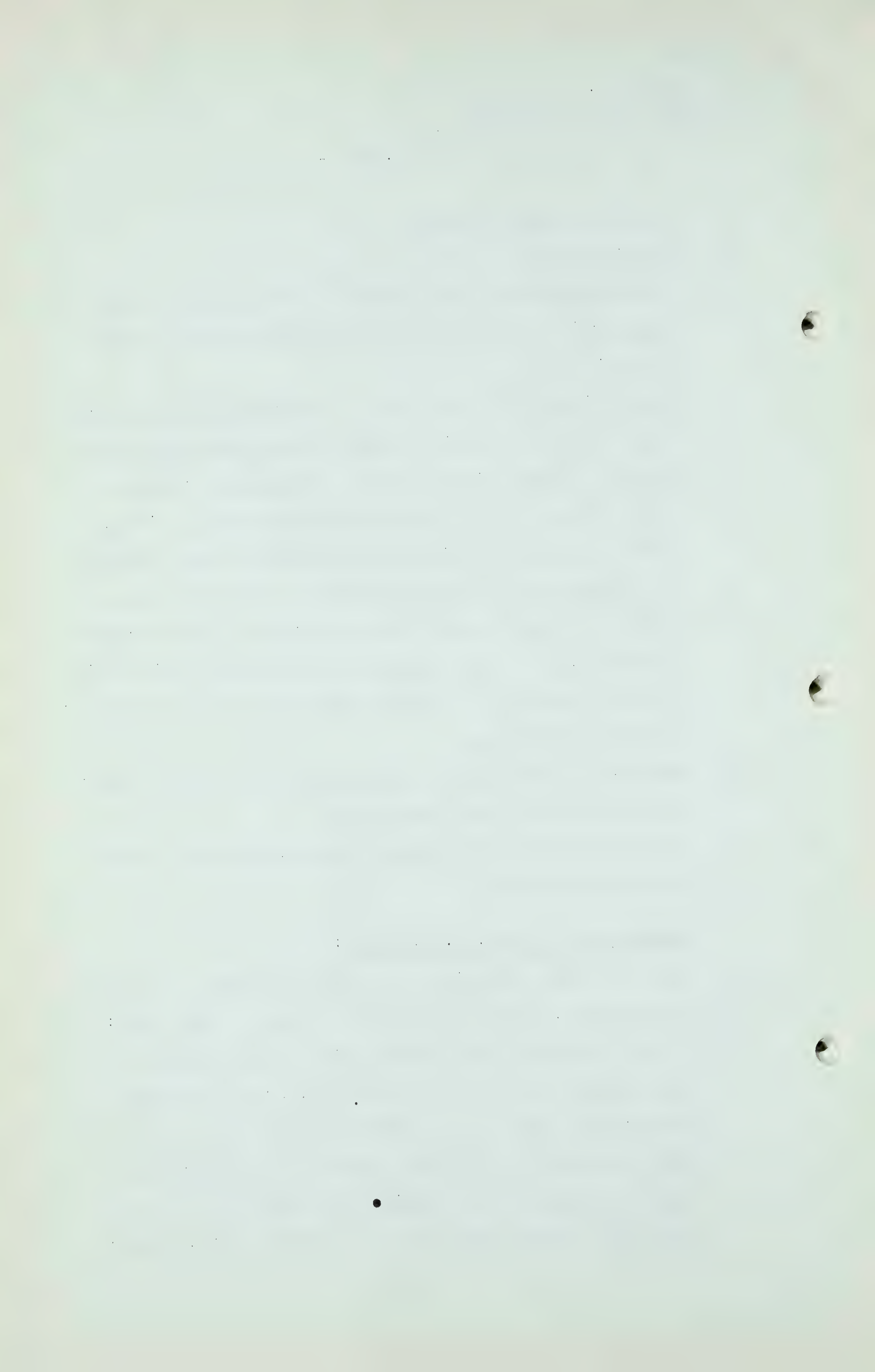
A There is drilling going on as I understand at the present time on the other side of Medicine Hat which might well extend the Medicine Hat field. We drew that line to point out the close proximity of these fields in the southeastern part of the Province and the very low cost for extending the present system and adding on these fields. We also had in mind Bow Island is an excellent storage field. I am told that the Bow Island field will take an additional 10 billion above what it is handling at the present time.

Q And was it your idea to take gas from the Medicine Hat field and put it into Bow Island?

A Only if additional development is brought about in the Medicine Hat area.

EXAMINATION BY MR. C. E. SMITH:

Q May I ask one question, Mr. Herring, on page 1 of your submission, Mr. Martland has just read it. You say:
" The conclusions to be drawn from the submissions of the various engineers and geologists as to the proven natural gas reserves." May I stop there and ask if what you refer to as proven natural gas reserves are those tabulated by Mr. Galloway on page 15 of his submission? Is that what you have reference to? Do you



R. Herring,
Exam. by Mr. C. E. Smith.

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understand what I mean?

A Yes, I do. Primarily these areas, we also feel that between the area of the Princess area and Calgary will be additionally developed and a certain amount of proved gas will be found in that area. We think that too is a logical extension of the present systems.

Q But all I was trying to get at is what areas - -

A That is primarily right.

Q Primarily it is as he has tabulated it?

A Yes, that is correct.

Q Primarily so?

A Yes, sir. We would like to state this one general fact just on that line, Mr. Smith, that we are extremely optimistic. I think I stated this that we are extremely optimistic of the development of reserves in Alberta and we have the same view in mind as all of the other applicants in acquiring additional gas and letting our system grow and we would take such gas made available to us and we would perhaps extend the transmission lines out to those various fields which would also make additional gas available from such fields, if arrangements can be made, to the local systems. We have the same view in mind that all the companies have and I feel we have one additional advantage of being able to export with a very small load.

THE CHAIRMAN: Thanks, Mr. Herring.

MR. McDONALD: There was one point I did not cover this morning. Mr. McMahon will deal with it. It is very brief and I will call him now.

Frank McMahon,
Dir. Ex. by Mr. McDonald.

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FRANK McMAHON, having been

duly sworn, examined by Mr. McDonald, testified as follows:-

Q Mr. McMahon, you are President of Westcoast Transmission Company Limited?

A Yes, sir.

Q You are the President of Pacific Petroleums Limited?

A Yes, sir.

Q Now, this morning in making the submission of Westcoast Transmission Company's Exhibit reference was made to the drilling of wells in the areas which were set out in those exhibits as being the source of supply of gas for the Westcoast Company. Would you state to the Board the drilling program which is in contemplation in these areas?

A Our company and our associates are currently drilling three wells in the northern part of British Columbia or in and around Peace River, close to the Whitelaw area, adjoining it in some cases. We are operating two seismic crews in that area and we, with our associates, control some 2 million acres of land in there that we are actively developing. Now further to that, we have negotiated with, we are carrying on negotiations at this time with Imperial Oil Company for definitely farm-outs of permits which they have in that area for gas alone, for the exploration of gas alone. And of course any oil that might be found in these leases. Further to that, we have been negotiating with Shell and B. A. Oil Company. We attempted to make a deal with them to develop land close to their Whitelaw discovery and they were going to immediately drill,



Frank McMahon,
Dir.Ex. by Mr. McDonald.

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I do not know how many wells but several wells in there for gas. Whether they are actually developing natural gas or oil they are very much enthused with the gas possibilities of that area. Further to that we have now a farm-out from the Stanolind Oil Company of some 5,000 acres adjoining this Whitelaw area. We have a well drilling in there now which we are prepared to carry on. We are drilling now without any semblance of an export licence but we are prepared to keep on now. We will also be prepared, that is our companies will undertake to do sufficient drilling to prove up the reserves and the deliverability for our projected lines. Particularly if we get a gas export licence. But we are doing it now without one.

Q As I understand it this well that is drilling on the Stanolind farm-out is some 9 miles - -

A About 9 miles from the Whitelaw discovery well with B.A. and Shell.

Q When you refer to "we" you refer to Pacific Petroleum Company which is the exploring and developing oil company?

A That is correct.

Q Are there any other wells drilling by your company in the Peace River area right now?

A Yes, there are two others. One is nearly 10,000 feet and the other is about 4500.

Q You have read the report that was submitted by Dr. Nauss this morning in which he refers to a number of wells drilling forthwith. Does your program include proceeding with those

T-4-11

Frank McMahon,
Dir. Ex. by Mr. McDonald.

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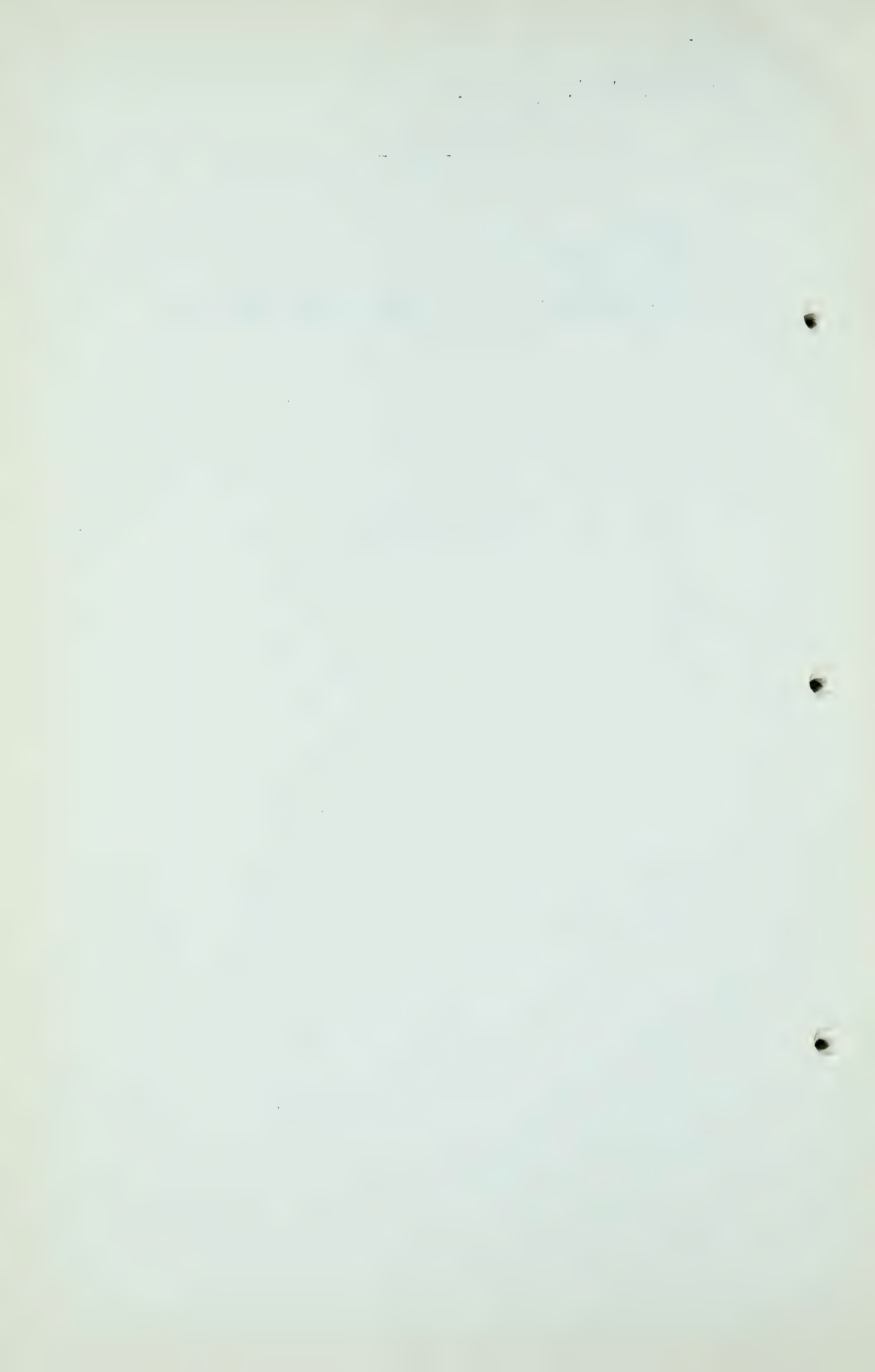
wells?

A Yes, it does.

MR. McDONALD:

That is all, thank you.

(Go to page 894.)



Discussion.

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MR. C.E. SMITH: I wonder, sir, Mr. Liesemer and Mr. Crockford are here and I wonder before we call them if I might call the Board's attention to the material that was sent in under cover of a letter from Imperial Oil apropos to Mr. Steer's request, I think it was, of Mr. Pot, but subject to any objection from counsel I fail to see why this Board and all these gentlemen should be called back here about Tuesday or Wednesday to have Mr. Mackenzie stand up and say, "Here it is". If counsel are agreed I think this may be considered as an exhibit unless somebody wants to come back next Tuesday or Wednesday.

MR. McDONALD: Agreed.

MR. NOLAN: Agreed.

ADDITIONAL TABLES 1, 2, 3,
RE LEDUC FIELD AS REQUESTED
BY MR. STEER PUT IN AND
MARKED EXHIBIT J-40.

MR. C.E. SMITH: Mr. Chairman, some of the counsel have mentioned to me that they would prefer if Mr. Leisemer was called first because of a matter of time subsequent to this afternoon's Hearing. Is there any particular difference who you call first? How long did you intend to sit this afternoon?

THE CHAIRMAN: We will sit until 4:30.

It looks as if we will probably have to sit in the morning.

MR. SMITH: It was Mr. Smith who just spoke to me and probably he can explain, or maybe other counsel desire the order changed.

MR. S.B. SMITH: My point was I am afraid I won't be here tomorrow morning. If it is more suit-

G.E.G. Liesemer,
Dir. Ex. by Mr. C.E. Smith.

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able for the Board to proceed with Mr. Crockford first,
all right.

THE CHAIRMAN: That is all right, we will
proceed with Mr. Liesemer.

MR. McDONALD: Mr. Chairman, would you give
me the number for the submission handed in by Mr. Mack-
enzie?

THE CHAIRMAN: Exhibit J-40.

G.E.G. LIESEMER, having been
first duly sworn, examined by Mr. C.E. Smith, testified as
follows:

Q Mr. Leisemer, you have prepared a submission which you
have in front of you there?

A Yes, sir.

Q Probably, sir, we could give it a number.

SUBMISSION OF MR. G.E.G.
LIESEMER PUT IN AND
MARKED EXHIBIT J-41.

Q I believe, Mr. Liesemer, you graduated from the University
of California with the degree of Bachelor of Science in
Chemical Engineering in 1929?

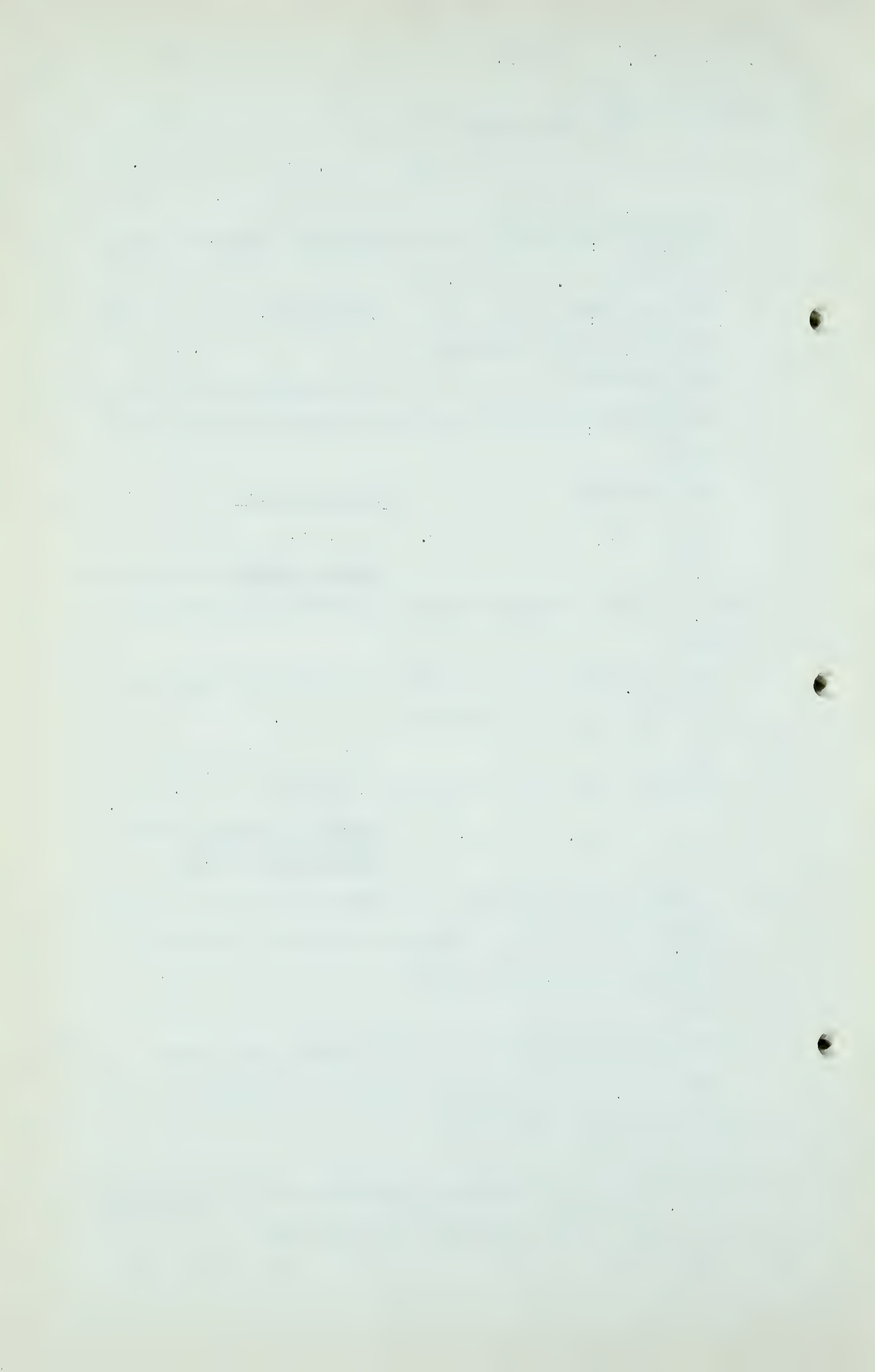
A Yes.

Q Without going through your life history since then,
briefly, you have been with the Board as engineer or
chief engineer since 1941?

A Yes, sir.

Q And I believe you prepared a submission which is presently
J-41, just having been marked by the clerk?

A Yes.



G.E.G. Liesemer,
Dir. Ex. by Mr. C.E. Smith.

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Q And that submission was prepared by you independently from the Board?

A Yes.

Q In other words, it is Liesemer's submission, if I may put it that way, Mr. Liesemer? When I say "independent from the Board", it reflects your own opinions and ideas about the matters dealt with in the submission?

A That is correct.

Q And neither I or anybody else has influenced you in preparing it?

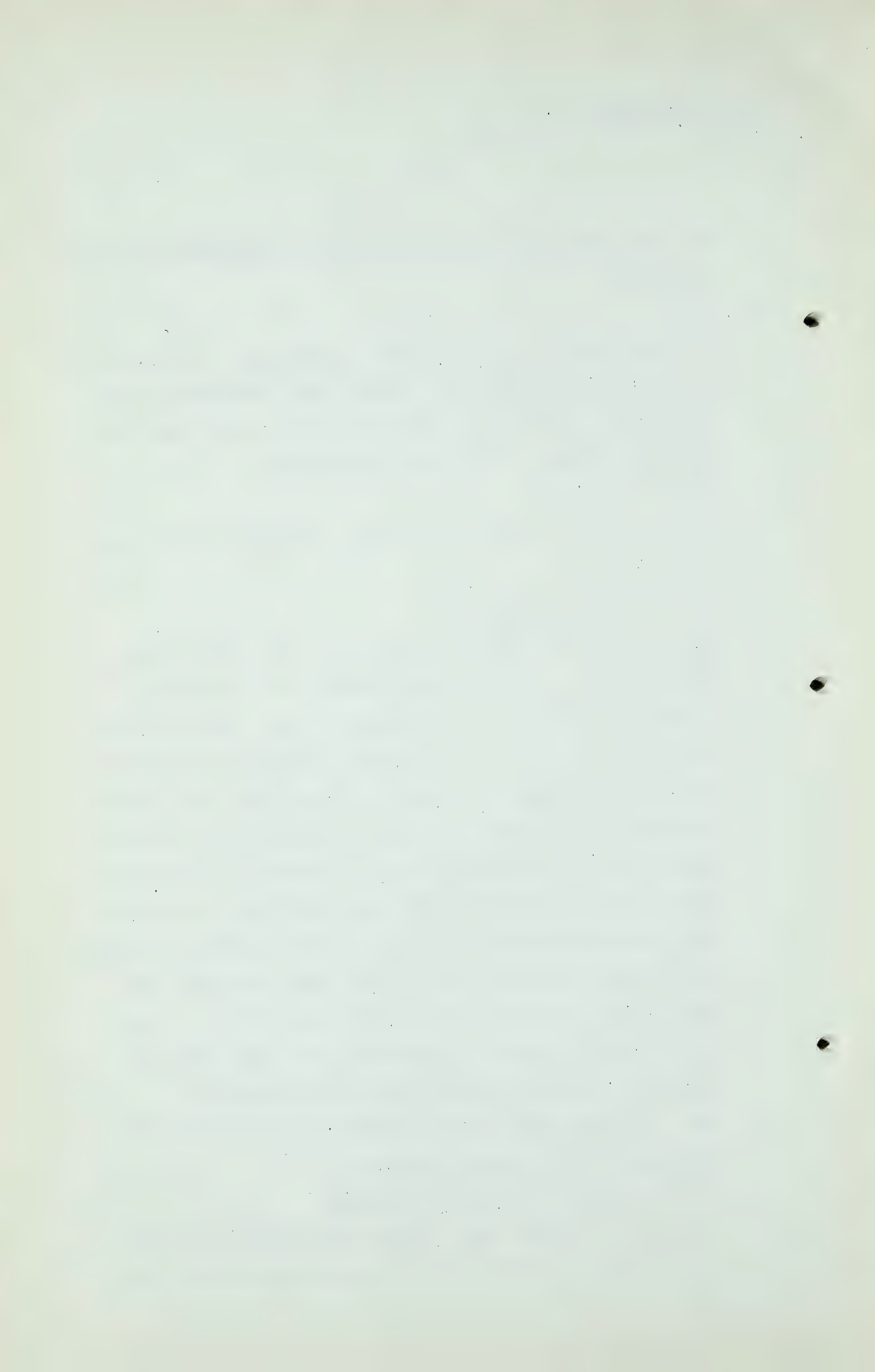
A No, in no way whatsoever.

Q Now, adopting the same method as you have observed has been adopted, I am not going to ask you to read this. There are just two matters, however, that I want to draw your attention to before I turn you over to the wolves here, if I may call them that. In the first place, with respect to your table, Mr. Liesemer, there is what might appear to some a clerical error and probably I think you can explain it in a few words, the very last item on your table which appears on the back of your submission. After Golden Spike and going over to the right hand side you have, in situ 35, producible 35, and come up with a total of 71, which is hard to figure out if we just look at figures. Would you explain that at this moment?

A Yes. In the assumption of the D-2 oil zone and the D-3 oil zone 131, if you will notice.

Q You are talking about Leduc-Woodbend?

A Yes, but 31 billions were considered as being marketable and the balance producible and processed, produced and



G.E.G. Liesemer,
Dir. Ex. by Mr. C.E. Smith.

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not processed, not going through the plant. We assumed the balance went to Golden Spike and was repressured.

Q In other words, part of your Leduc-Woodbend gas is re-processed through Golden Spike and produced through there?

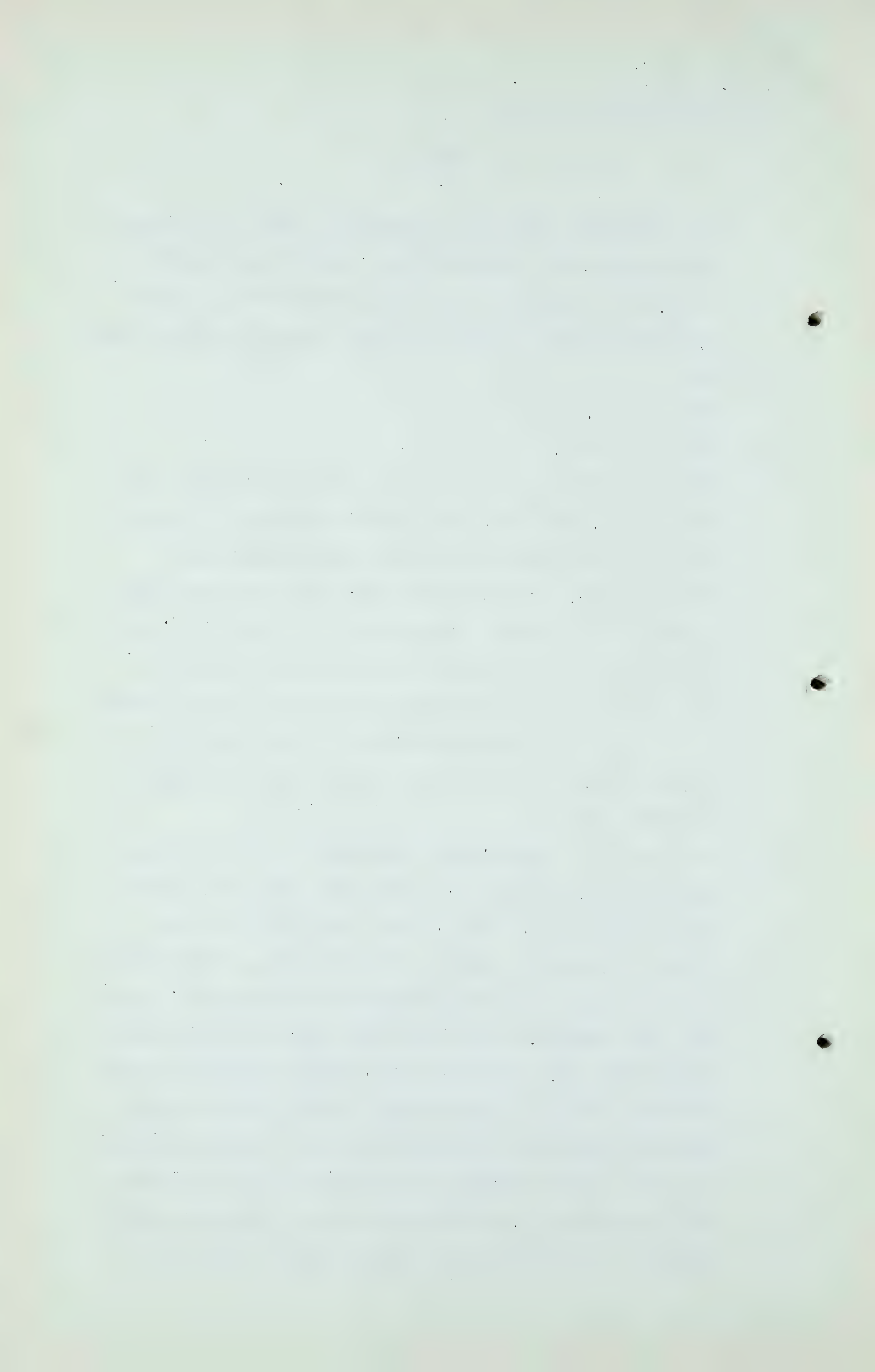
A Yes.

Q That is why we get 31?

A That is right.

Q One other matter, Mr. Liesemer, and that is this, that throughout these Hearings a number of people, I think including Mr. Galloway, have in various ways and to various degrees considered in particular one field that I have in mind, namely, Morinville. I notice in your submission you did not deal with that in particular. You do give a map to give some information but it struck me that possibly some explanation of your reason for not so doing similar to what other people have done might be of value now.

A At the time of the Dinning Commission's first sitting here, two local wells, two Morinville wells and two Bon Accord wells, were known. Since then there has been other development. First, looking at the general geology it would appear that major fields were developing. Since that time Redwater is at least two-thirds drilled, Leduc better than half, Excelsior about half, Campbell-Redwater less than half. In other words, we have better control now and nothing has happened that would change our minds as to the highly erratic nature of the Lower Cretaceous, and inasmuch as that practically all of these so-called probably reserves, as some people classify them, and I



G.E.G. Liesemer,
Dir. Ex. by Mr. C.E. Smith.

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would prefer to call them possible, are of such a dubious nature we have not attempted to place any overall reserve picture on them.

Q When you say "we", you mean you?

A I should say in collaboration with my colleague, Mr. Crockford.

Q I take it then, Mr. Liesemer, that having regard to what you said, the expression you use on page 8 at the bottom of the page, where you conclude with some general remarks there, you say:

"At the same time we can not discount the possibility that future exploration might find continuous bedding over wide areas and much larger gas reservoirs than so far discovered."

A Yes, sir.

Q That is your position. In other words, insofar as the Lower Cretaceous, such as Morinville is concerned, you do anticipate the possibility of large reserves being eventually delineated there, is that right?

A That is correct. I prepared a table here. This is taken from a text-book on petroleum geology which shows the proportion of distribution of petroleum products in the world to January 1st, 1947.

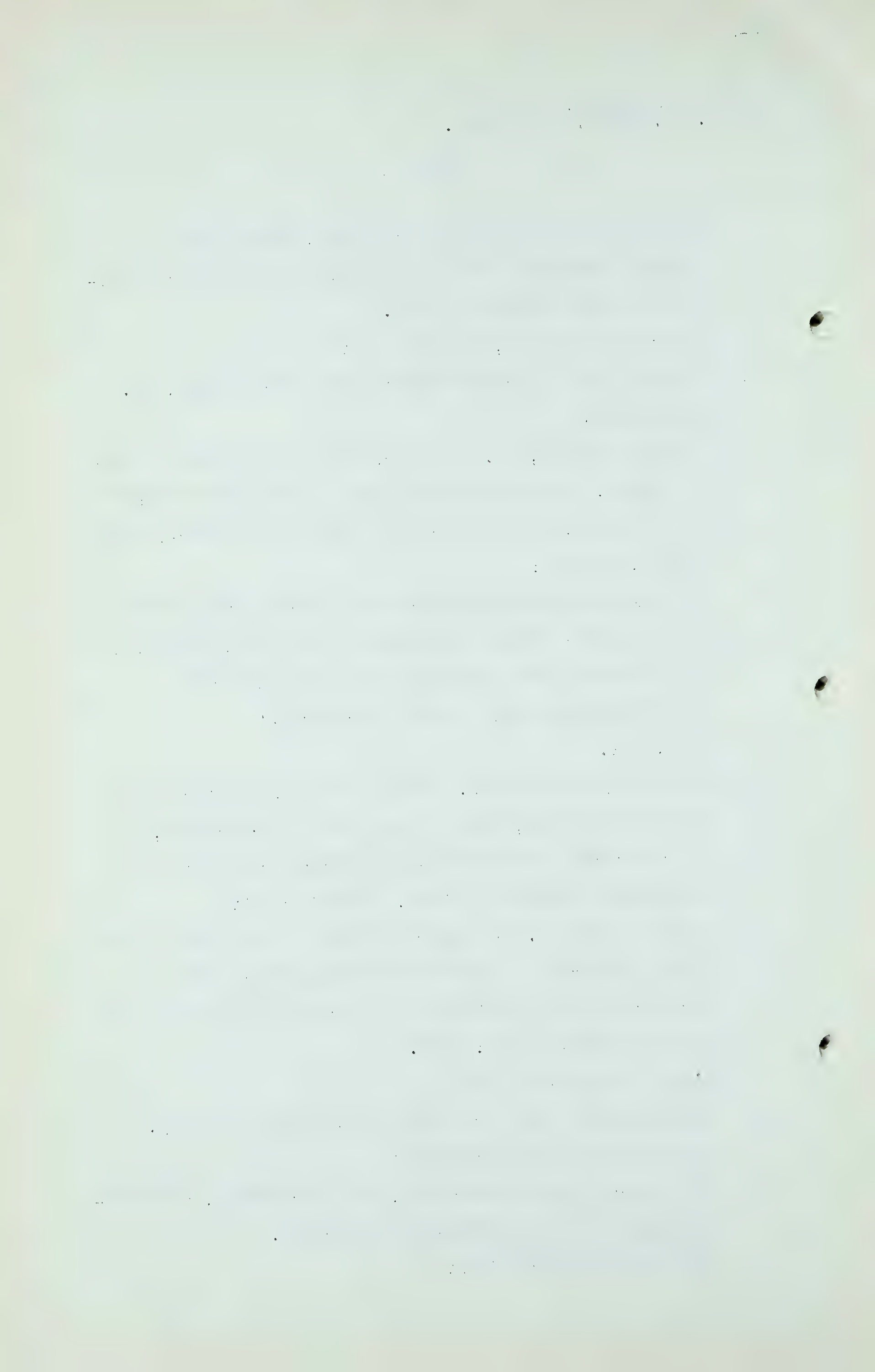
Q What is that taken from?

A From Lalicker "The Principles of Petroleum Geology."

Q And the table discloses what?

A It indicates the proportions, the percentages, approximate percentages of petroleum production.

Q From various formations?



G.E.G. Liesemer,
Dir. Ex. by Mr. C.E. Smith.

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A From various formations.

Q Throughout the world?

A Throughout the world, yes.

Q As a matter of fact, Lower Cretaceous is quite high, was 16 or something?

A Yes, it is. If anybody else wants to have this I can pass it around.

Q Probably seeing the witness has referred to it it might be marked.

CHART SHOWING THE
STRATIGRAPHIC DISTRIBUTION
OF PETROLEUM PRODUCED IN
THE WORLD TO JANUARY 1st,
1947, MARKED EXHIBIT J-42.

Q Then I take it, Mr. Liesemer, that having regard to Lower Cretaceous here, Cretaceous being in the 16% average, that that is one more reason why you anticipate the possibility of large reserves, but at the present moment you do not feel that in your opinion you should categorize that as so many hundred billion cubic feet or anything of that nature?

A One of the very disappointing things in exploration is the fact that the Lower Cretaceous has not proven more prolific but we are always hoping.

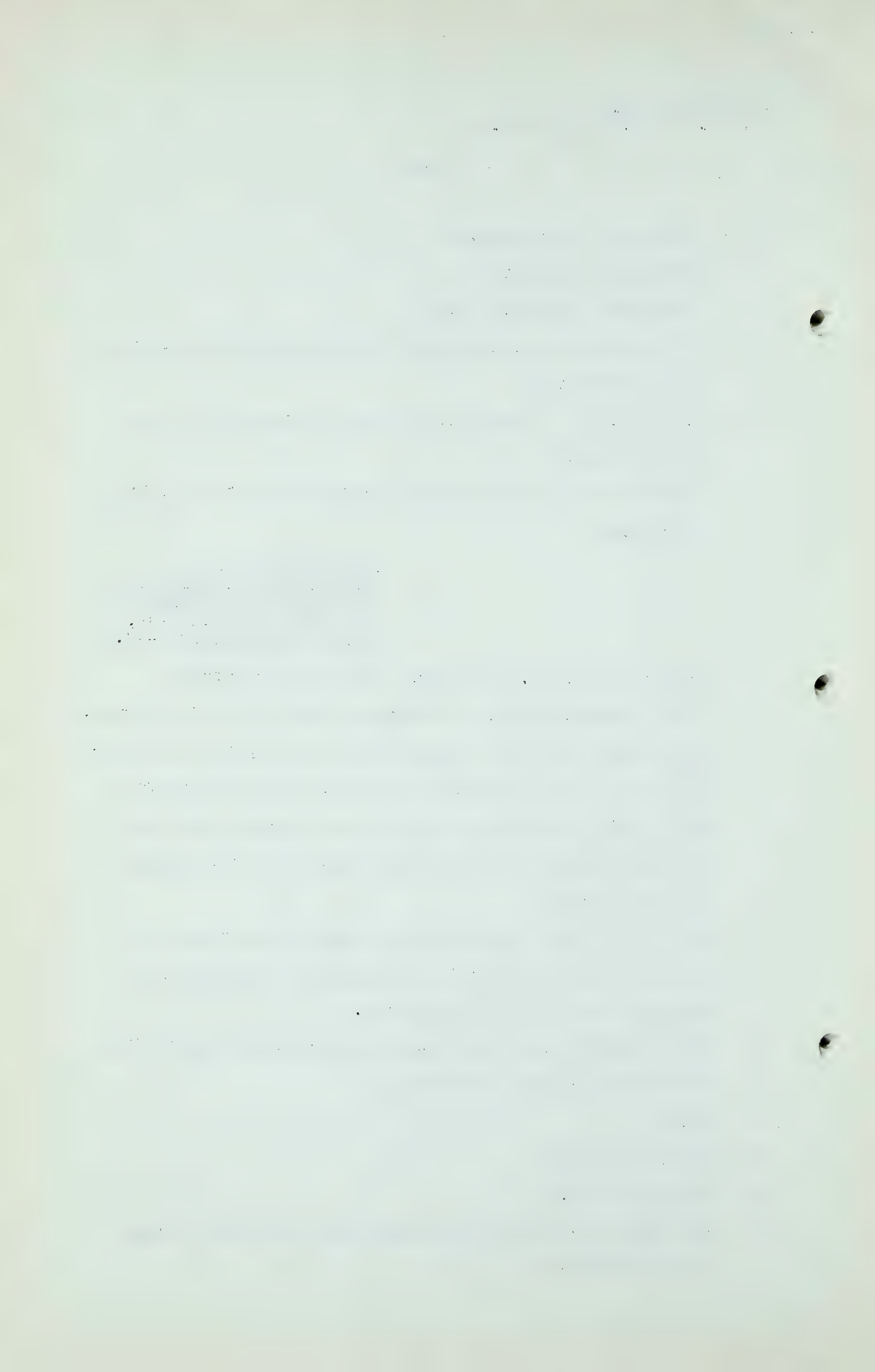
Q If it follows the world trend as expected by Exhibit 42 it should be rather prolific?

A Yes.

Q And may be yet?

A And may be yet.

Q You heard discussion about Whitelaw in the last couple of days evidence?



G.E.G. Liesemer,
Dir. Ex. by Mr. C.E. Smith.

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A Yes.

Q I observe insofar as Triassic is concerned in J-42 it is in a pretty low spot, .05%?

A As a matter of fact, this table was originally prepared when the discovery was first made, which struck me that we had had no previous knowledge of any production in the Triassic in Canada. On investigation I found Triassic production is very rare the world over. For that reason, I think I should approach the Whitelaw discovery with a certain degree of caution.

Q Having regard to whatever is known of Whitelaw now, it might develop into a very big field, is that a fair way to put it?

A That is correct.

MR. NOLAN: I was going to ask Mr. Liesemer a few questions but Mr. Smith, who will not be here tomorrow, can go ahead if he so wishes.

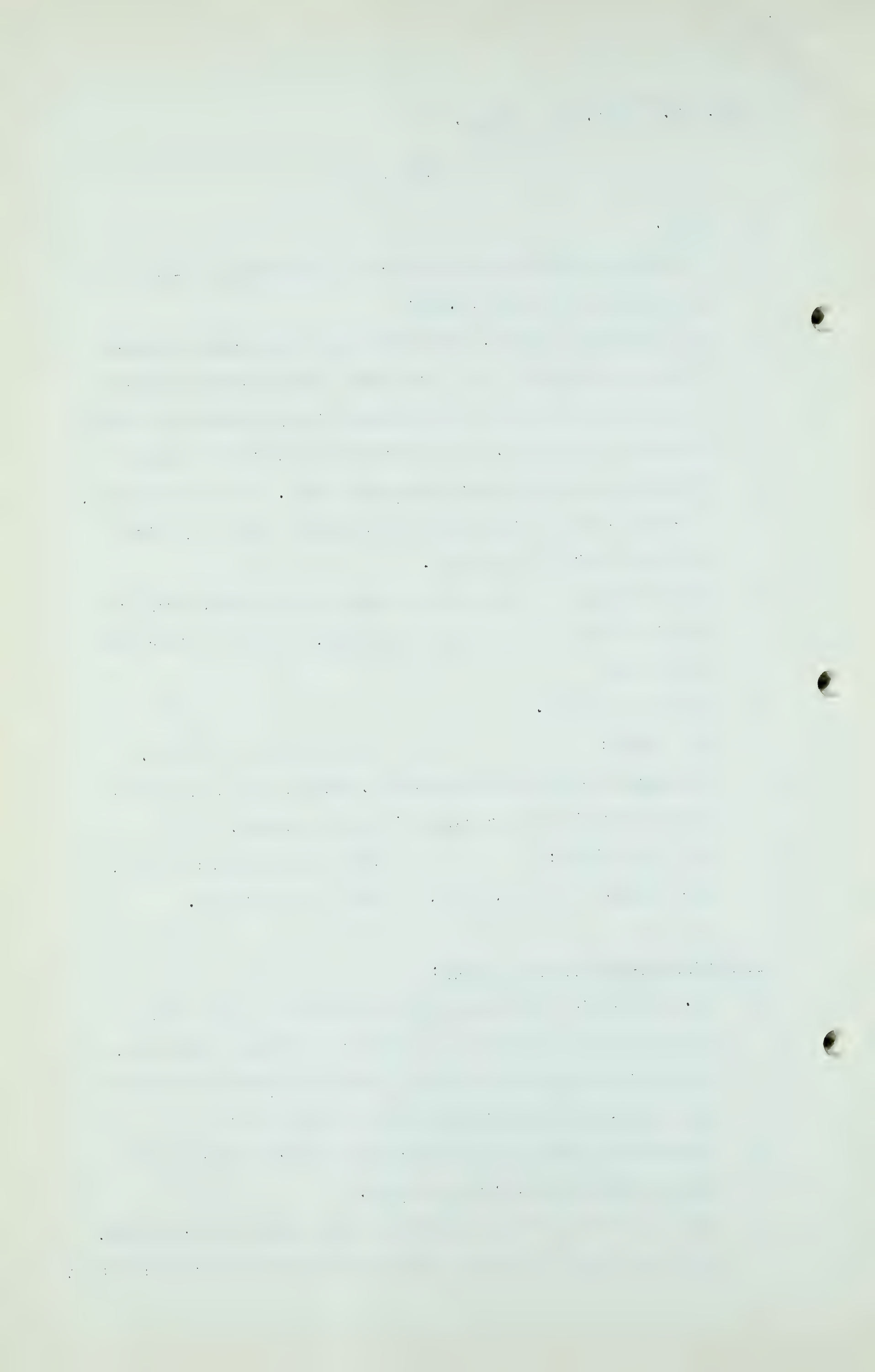
MR. S.B. SMITH: That is very kind of you, Mr. Nolan. I think, sirs, we have no questions.

CROSS-EXAMINATION BY MR. NOLAN:

Q Mr. Liesemer, I was just going to ask you a few very general questions upon this matter of making estimates. This factual data from which these estimates of reserves are based, just generally tell me what it is?

A Wherever we had enough production history we tried to make a material balance estimate.

Q And is all that data available to all persons such as Dr. Hume and those who have been called by the other applicants?



G.E.G. Liesemer,
Cr. Ex. by Mr. Nolan.

- 901 -

A Yes.

Q During these Hearings?

A Yes.

Q That same information is available to them all. And I think we have been told, Mr. Liesemer, that some of the companies have a particularly intimate familiarity with their own fields, for example, Imperial in Leduc?

A Yes.

Q McColl Company in Pendant d'Oreille, the Standard of California in the Princess field, the Gulf in respect to Pincher Creek. They have what I call an intimate familiarity?

A That is correct.

Q And I suppose you will agree with me, Mr. Liesemer, that the reliability of estimates made by gentlemen in your profession is chiefly based upon the knowledge and the experience and the judgment of the estimator?

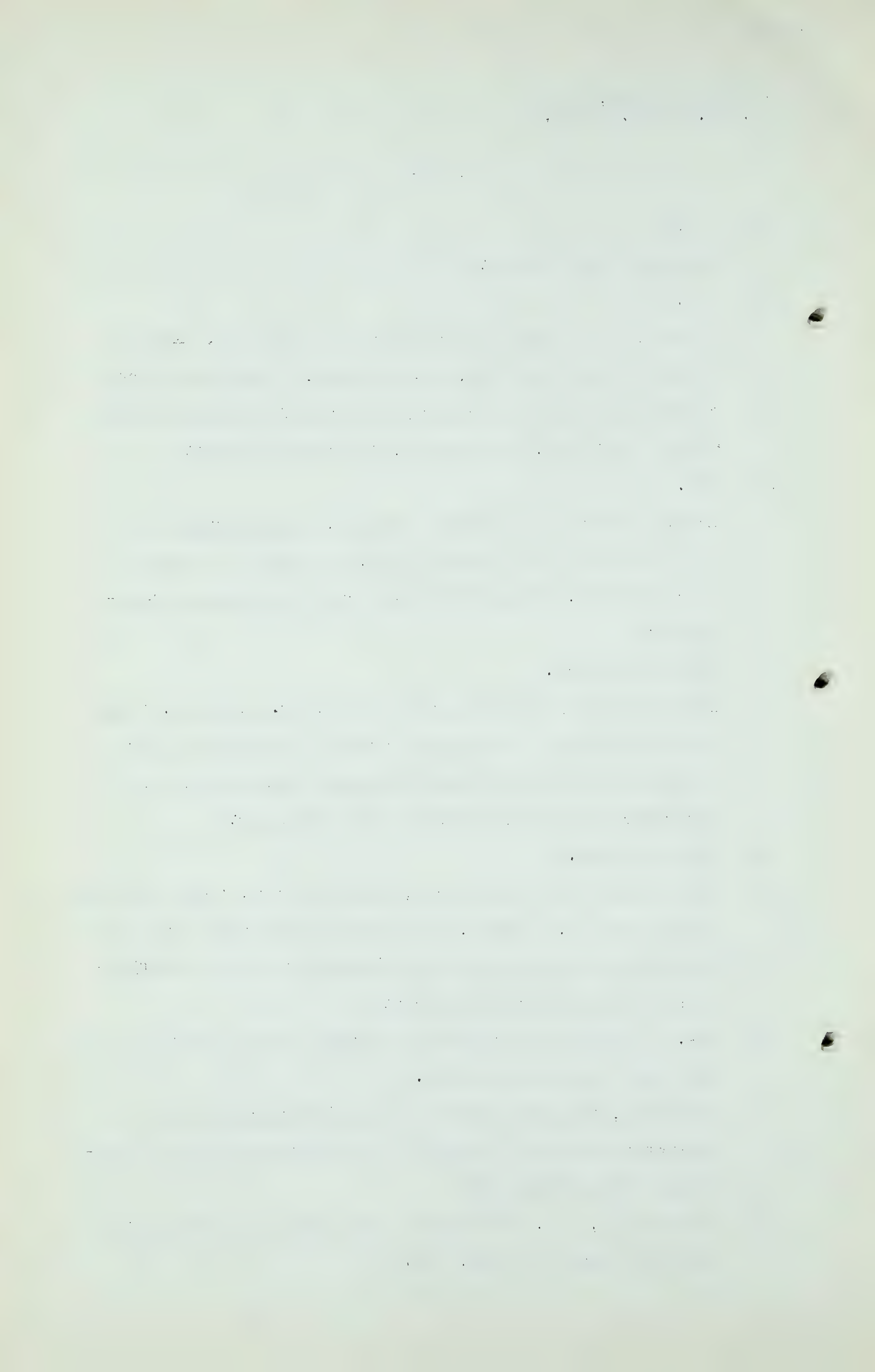
A That is right.

Q And if there are differences, and there are, and I suppose always will be, perhaps, it is fair to say also that those differences are based on the differences in the interpretation of the fundamental data?

A Yes. Possibly differences of opinion arising over some of the data that was presented.

Q Well then, the reliability of the differences in the estimates should be judged by the experience and the knowledge of the estimator?

A Possibly so, too, and then I think also you might introduce the idea of motive, too.



G.E.G. Liseemer,
Cr. Ex. by Mr. Nolan.

- 902 -

Q Of what?

A Of motive.

Q Motive?

A Yes.

Q What motive do you suggest?

A I am simply pointing out if a man desired a market it might possibly colour his judgment to a certain extent.

Q Now, Mr. Liesemer, I do not want the Board to view with alarm this large document which I hold in my hand. It is simply something which we prepared last night which we thought might facilitate any examination of Mr. Liesemer by drawing up a comparison of the various estimates of the marketable gas given before this Board up to 1:00 o'clock yesterday afternoon, and with the Board's permission I will put one of these copies before Mr. Liesemer so that he might just look at it because there are one or two things I want to ask him about.

MR. C.E. SMITH: I hope you have lots of copies, I would like to have one.

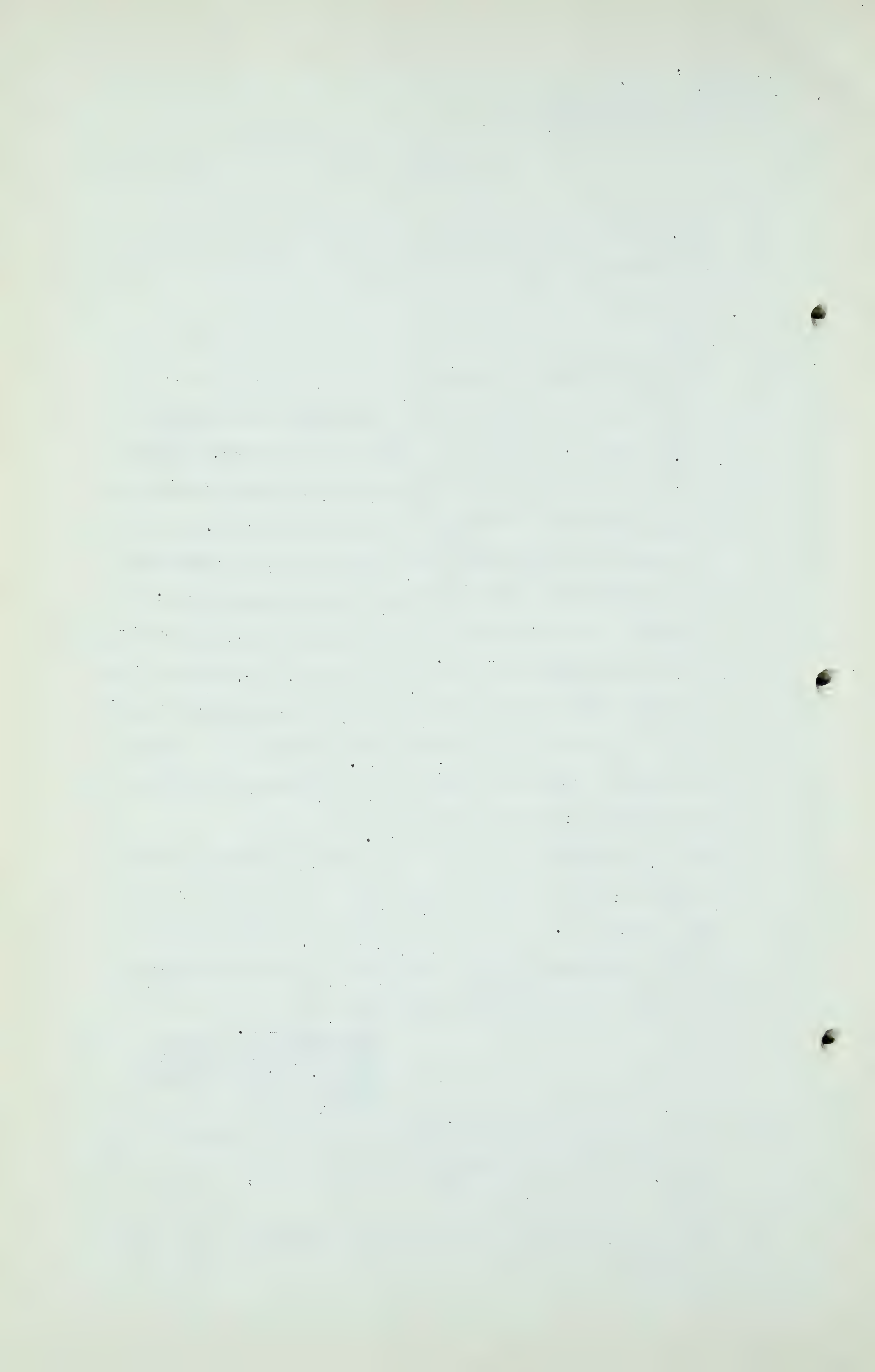
MR. NOLAN: It so happens I have not lots of copies. We only prepared it last night and we have not had a chance to duplicate it.

COMPARISON OF VARIOUS
ESTIMATES OF MARKETABLE
GAS PUT IN AND MARKED
EXHIBIT J-43.

Q Do you see what that purports to be, Mr. Liesemer? The fields are in the left-hand column?

A Yes.

Q And your estimate is in the first column, if I may call it that?



G.E.G. Liesemer,
Cr. Ex. by Mr. Nolan.

- 903 -

A Yes.

Q And the next are the estimates of the Northwest Company, Westcoast, Canadian Western and Northwestern Utilities, Prairie Pipe Lines, Western Pipe Lines, McColl-Union, Imperial-Gulf, and the figures of the Westcoast are up-to-date figures. By that, I mean that they have been brought into harmony with the last evidence produced by that company.

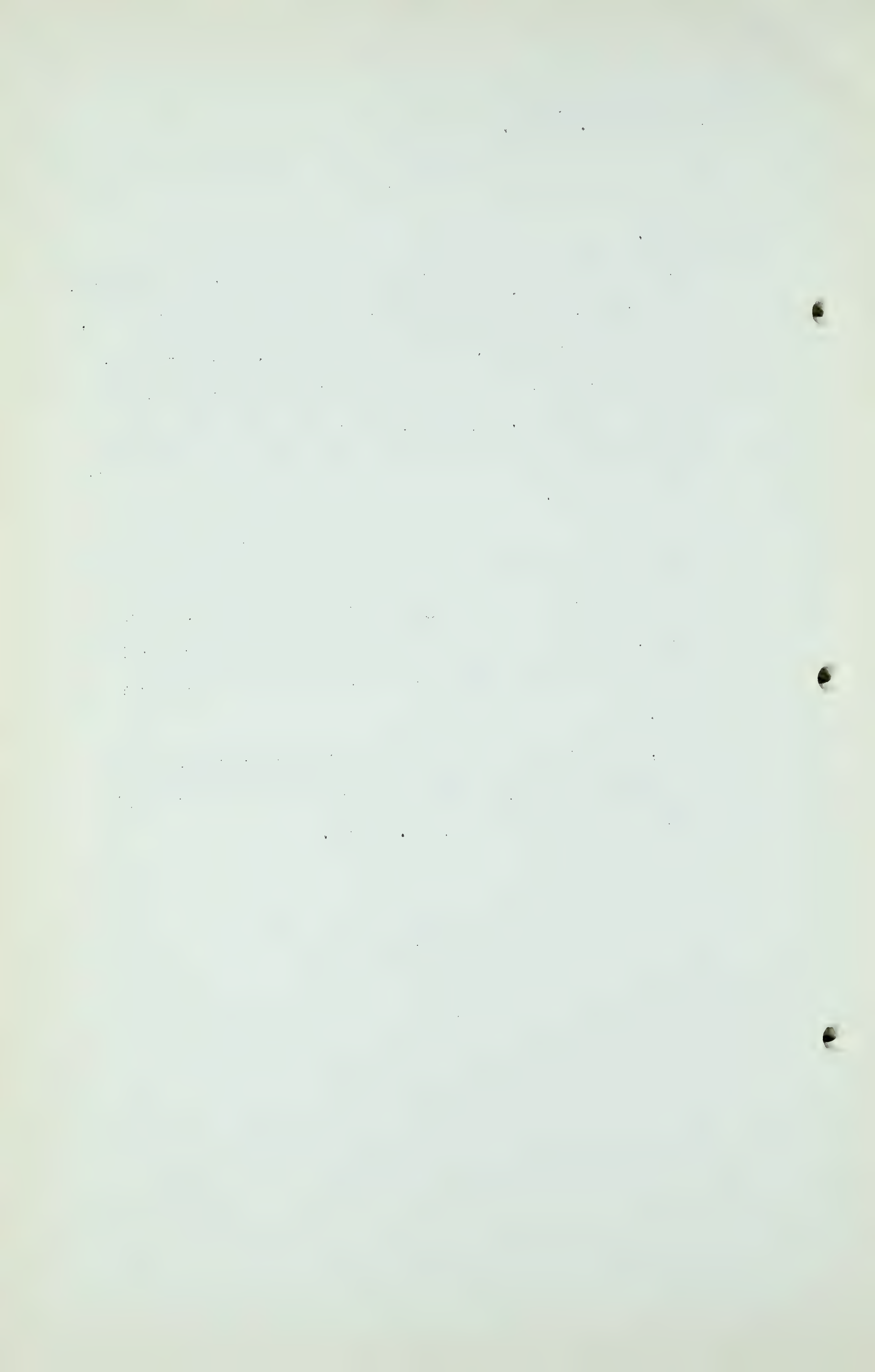
The first point that I wanted to make with you was with respect to your estimate in the Leduc Field. I gather from your brief, which is J-41, that there is a certain amount of gas production in the Leduc field deferred because of oil recovery?

A Yes.

Q Now, so far as the gas cap itself is concerned, do you consider that to be deferred because of oil recovery?

A That was my assumption, Mr. Nolan.

(Go to page 904)



G.E.G. Liesemer,
Cr. Ex. by Mr. Nolan

- 904 -

Q In other words, you are saying we have to take out all the oil before we can get at the gas in the gas cap?

A Possibly I can explain that.

Q Yes?

A I went to Imperial Oil to try and find out something regarding their thinking on reservoir pressures, and such evidence as was submitted by Mr. Mackenzie and Mr. Pot the other day I was unable to obtain. The only firm statement that I was able to get was that they had no intention in the foreseeable future of enlarging the absorption plant.

Q Yes?

A On that basis I assumed so much gas would go down the line and so much would be re-injected, and if they maintained their reservoir pressure I assumed there would be no break-through.

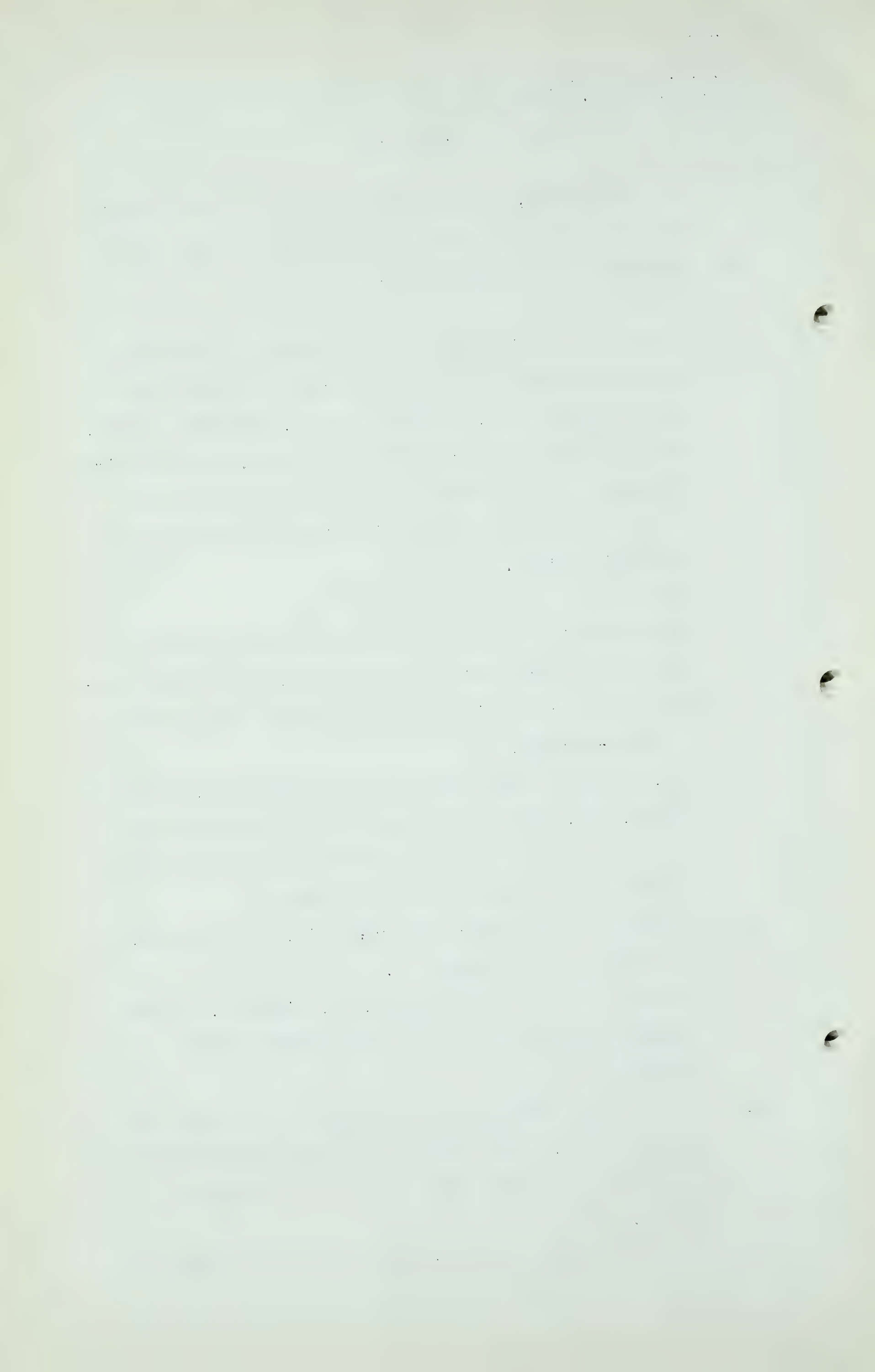
Q Now, having had the opportunity of hearing Mr. Mackenzie and Mr. Pot, have you anything to say on the question as to your estimate and your remark with regard to the deferment of the gas to the oil recovery?

A I would be almost forced to change it. Unfortunately, my submission was already in.

Q I think it is only fair to you, Mr. Liesemer. To what extent would you alter it in view of this latter evidence?

A I do not know what would be deferred. I have not the faintest idea. That question was asked Mr. Pot about the thing, and he was most reluctant in making an answer.

Q In the oil zone in the D-3 you show no gas reserve at



G. E. G. Liosemer,
Cr. Ex. by Mr. Nolan

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all?

A In the oil zone in the D-3 no gas reserve at all?

Q Yes, isn't that right?

A No, 298 - what happened there was that 131 should be bracketed opposite the 111 and 298.

Q 111 and 298?

A Yes, 111 and 298.

Q Then you are taking into consideration what we call solution gas?

A Oh, most definitely.

Q I was not quite sure from the set-up of your statement whether you were or were not?

A Oh, yes.

Q And is that amount that you are allowing for solution gas contained in your total for the Leduc area?

A I think it is worked out in my description of the Leduc field there.

Q If it is included in the total that is all right?

A Yes.

Q It is?

A Yes.

Q Then we will go on to the next, that is the Legal, Bon Accord and Picardville?

A Yes.

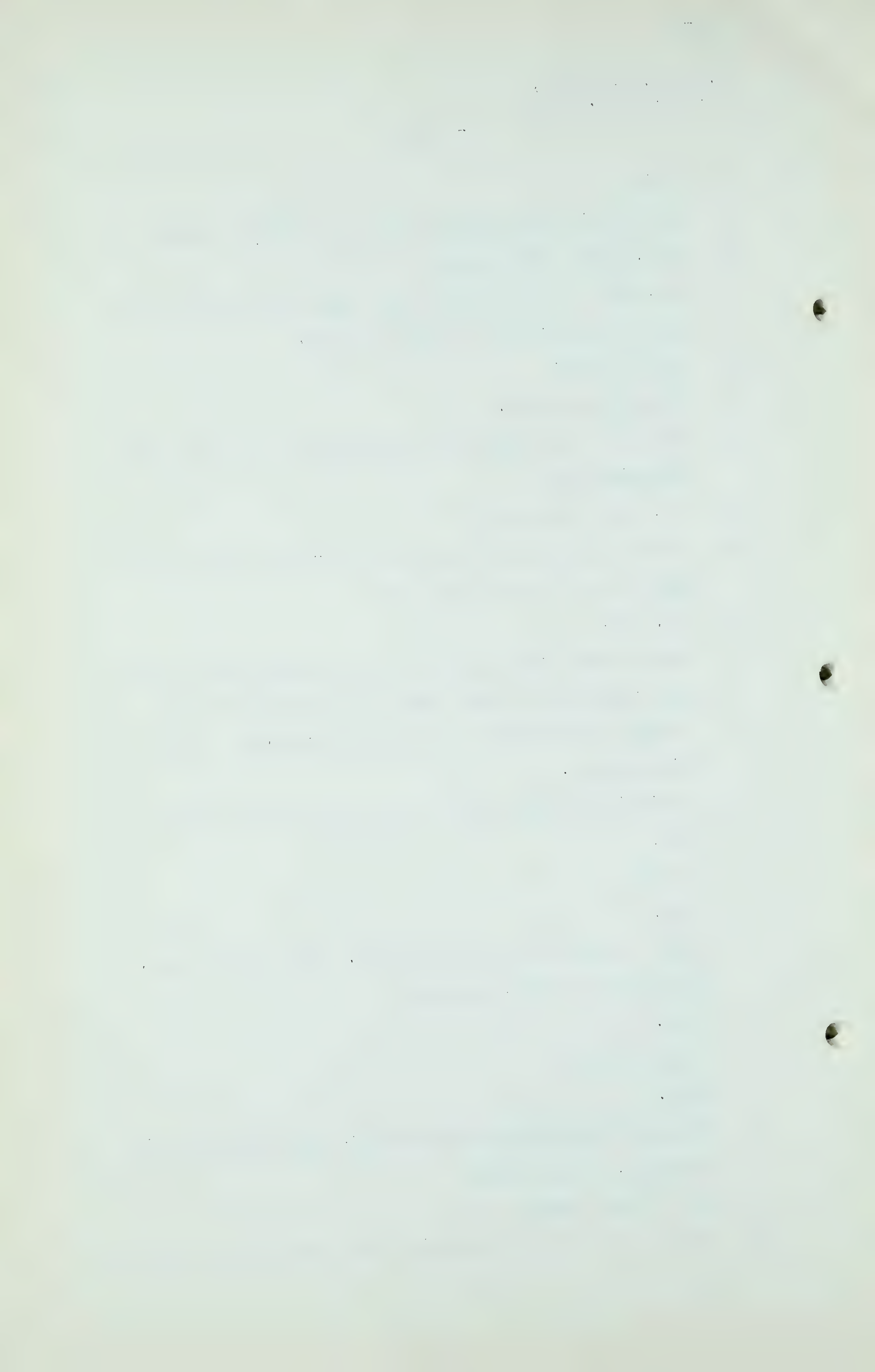
Q Those fields?

A Yes.

Q You were discussing that with Mr. Smith, the Board's counsel, a moment ago?

A All of the general area.

Q Because it was in connection with those fields that you



G. E. G. Liesemer,
Cr. Ex. by Mr. Nolan

- 906 -

mentioned Morinville, was it not?

A Yes, that is correct.

Q And would you please tell me again why you show nothing in respect of those fields, whereas it seems to me there are considerable estimates, or at the same time there are considerable estimates shown by other gentlemen who have made estimates and given them to the Board?

A It is largely based on the amount of acreage assigned to these various fields.

Q Yes. Well, what acreage were you assigning?

A Which one did you have in mind?

Q Well, I consider those as three separate and distinct discoveries.

Q Morinville, Calahoo and Long Island?

A Yes.

Q And you gave no reserve figure?

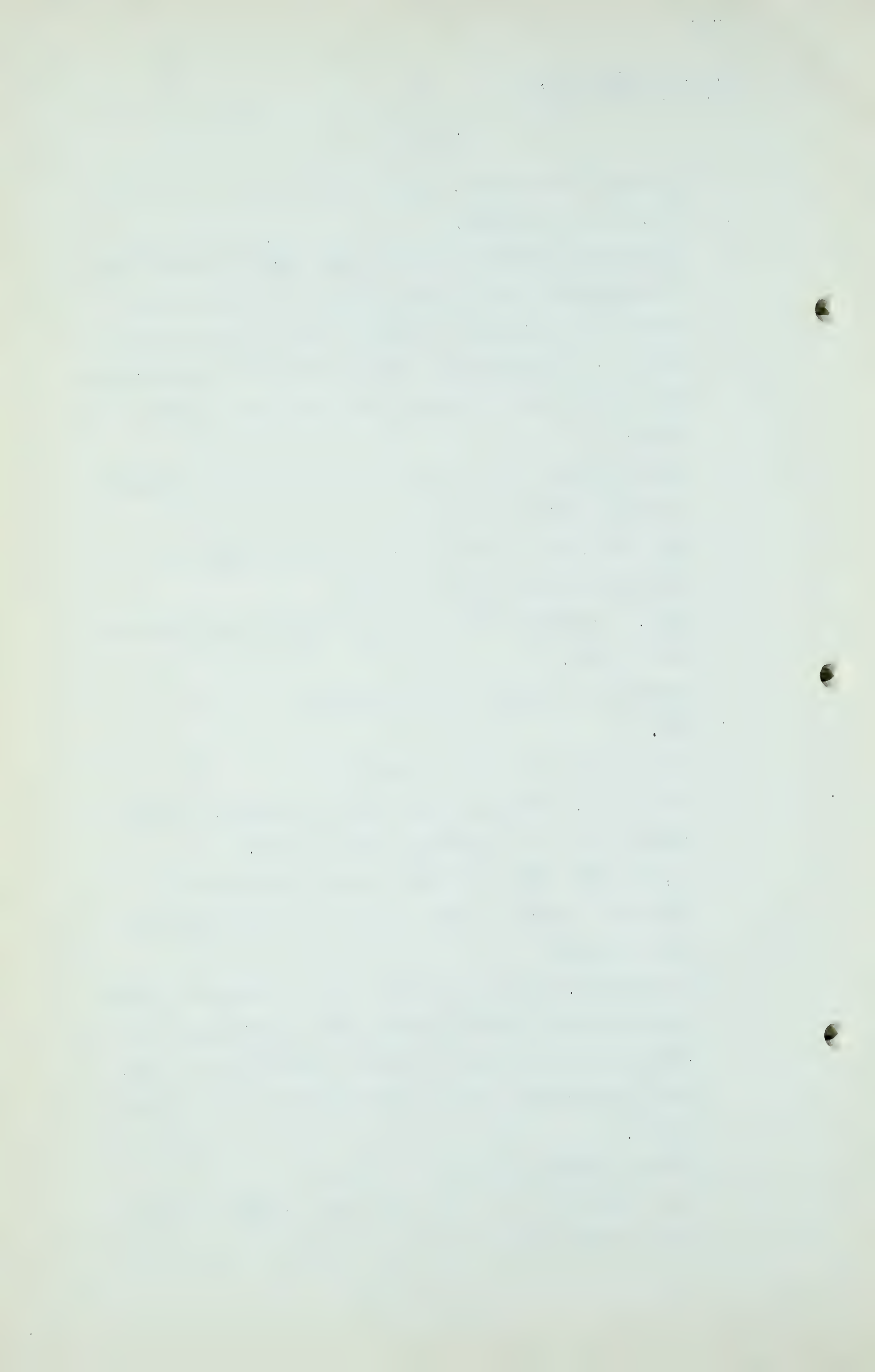
A Yes, I did. They fell below the 20 billion, which I considered to be included in this report.

Q Oh, did it? Would you mind stating that again, I am awfully sorry. I did not get the last statement that you made?

A In Appendix, let us see what it is, I stated or quoted from the Smith Wimberly Report that the minimum size used by Dr. Golyer was 20 billion cubic feet or more, and I arbitrarily assumed that figure as the minimum figure.

Q Is the estimate contained in this?

A No, I included it in this table with regard to two or three little fields at the south end.



G. E. G. Iiesemer,
Cr. Ex. by Mr. Nolan

- 907 -

Q But you made some allowance for Morinville, Calahoo, and Long Island?

A Not in that Table. In fact, that fell below 20 billion, for instance, for all of this area. With the varying thicknesses, I have got 2.05 billion for Morinville 1, 3.07 billion for Morinville 2, and 1.54 billion for Calahoo 1.

Q Yes?

A And the reason I have not included them, the biggest reason that I have not included any of those wells is the elevation of the water line. They have all a different water table.

Q And you did not include them in your Table?

A No, I did not.

Q Well, we can disregard those as far as your estimate is concerned?

A At the moment - they stand as individual discoveries and not economically gatherable, and I left them alone. Further discoveries may prove I am wrong. That is very possible that they will do so in the near future.

Q You will agree that most of the other estimators have given us a figure for that particular field?

A Yes, I think practically all of them did.

Q So that, consequently, you disagree with them for the reasons you have given me just now?

A That is correct.

Q Now, just going down a little bit, down to Redwater, and you give nothing for Redwater?

A No.

Q And some of the estimators agree with you that there

G. E. G. Liesemer,
Cr. Ex. by Mr. Nolan

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should be nothing for Redwater?

A Pardon?

Q Some of the other estimators agree with you that there should be nothing for Redwater?

A Yes.

Q They are of that opinion too?

A Yes. It seems that the daily production probably is beyond what we have, we have about 5 or 6 billion, and we have a very elaborate report from our field engineers on that, and they think better than half of it will be used for field fuel, and at the present state of the field I do not think more than 3 or 4 billion cubic feet of gas will be gathered in that process.

Q Following that, Smith Coulee, the average of all, as compared with you, is very close?

A Yes.

Q Not far enough apart to make any difference?

A Yes.

Q 7 billion as against 8 billion?

A Yes.

Q Manyberries, you are in accord too with the average, are you not?

A Yes, that is correct.

Q I have worked that out. And there is not very much difference in Black Butte, is there?

A That is correct.

Q And we have talked about Morinville?

A Yes.

Q And then Pendant d'Oreille?

A Yes.

G.E.G. Liesemer,
Cr. Ex. by Mr. Nolan

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Q You have 173 billion as opposed to an average of 239 billion?

A Yes.

Q There is quite a difference there? Perhaps you would like to tell me why you are so far below the average?

A I do not know, Mr. Nolan. I would have to look all over the other calculations to be able to answer that question.

Q All right. Then in Pincher Creek, there is a ^{great} deal of difference between you and almost all the other of the estimates that have been made?

A Yes.

Q Is that because you took that area into consideration?

A No, it is not. Let me see what page that is on? I might go through that, if you wish.

Q I do not want to detain you unduly, but if you could just give it to us?

A That is on Page 10.

Q Yes?

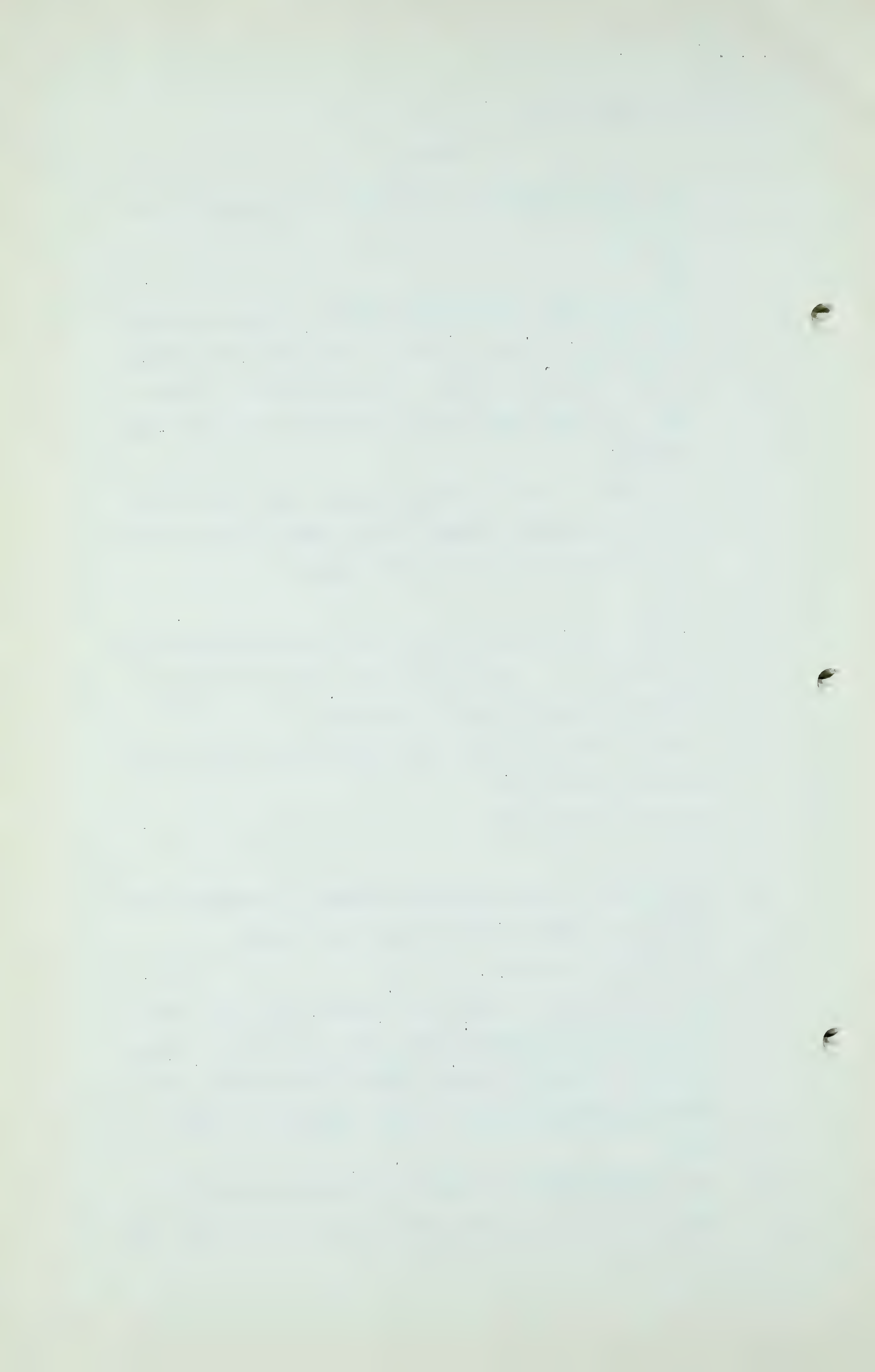
A I accepted all the data as presented by Canadian Gulf. I believe their acreage figure was 17,250.

Q Yes, that is correct.

A And bearing this in mind that we have only two wells that are actively productive, and one well in a tight part of the field, a tight part of the terrain, or a more unproductive part, I made a discount of 25%.

Q Yes?

A This represents what happened at various times or various places in Turner Valley, where there was taken



G. E. G. Liesemer,
Cr. Ex. by Mr. Nolan

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somewhere between 35 and 40%, varying with the condensate.

Q Would that bring about the difference in total?

A It would give you, the first figure there, in place, that figure is 1269 billion cubic feet, and the major part of the balance of that difference would be in the fact that over and above that there is 13.29% shrinkage for acid gas, and I then turned around and allowed 6% for the processing loss and 10% for field loss.

Q Yes?

A I think probably my deductions for the various losses between producible and marketable would account for most of the differences in these.

Q That is the difference between your 771 billion and the average of 1240 billion?

A Yes. It must be remembered with two wells in the field any estimate is bound to be tentative.

Q Now, in the Princess Basal Alberta, you have a note that it is beyond the economic reach of the pipe line. There has been no estimate made in respect of that by some of the other estimators, but you give no figure at all for the Lower Cretaceous in the Princess field?

A I thought I did, Mr. Nolan.

Q Well, maybe I am wrong?

A The Sunburst sand at Princess 87.

Q Is that the Lower Cretaceous?

A Yes, that is the Basal Cretaceous sand, the Basal Lower Cretaceous sand.

Q So that we should put the figure in there of 87 for the Lower Cretaceous?

G.E.G. Liesemer,
Cr.Ex. by Mr. Nolan

- 911 -

A Yes.

Q And with regard to Turner Valley and Viking-Kinsella there is no difference worth speaking of?

A No.

Q Neither is there at Bow Island, or Medicine Hat, or Foremost?

A No.

Q But there seems to be quite a difference in Pouce Coupe? In Pouce Coupe, Mr. Liesemer, we had only two estimates, we had the McColl-Frontenac of 41 billion, and the Westcoast of 122 billion, making an average of 81 billion. You seem to have followed the lower of these two estimates.

A This was taken from a submission that I made before this Board at Edmonton during mid-summer. Dr. Nauss also appeared at that time. And my recollection now is, I believe that the majority of the difference hinges upon two factors, the actual size of the area and the thickness of the sand.

Q Yes?

A Now, he introduced some evidence, Dr. Nauss introduced some evidence, I should say, to the effect that he had cored a full section in a recent well, I think it is the P.R.N.G. Wilrich, and that might force me to change my amount also in connection with that matter.

Q It might necessitate a change?

A Yes.

Q In other words, your amount will be changing as more information and data is made available?

A Yes, always.

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Q And I notice lastly, although there is not much difference in the Provost field, but in the Golden Spike you have a very large reserve as opposed to the other estimators.

Q That, again, Mr. Nolan, is based on the fact that I included the gas that I presumed would be used for pressure maintenance in Golden Spike along with the gas originally in place.

Q Yes?

A I assumed that the gas produced at Golden Spike, together with a large portion of the separator field gas in the Woodbend area would go back into the formation, would be put back into the formation for pressure maintenance, and it would not represent what was originally in place, but would also contain what was injected into the formation.

Q When that was done?

A That was my assumption.

Q And is it practical to do it?

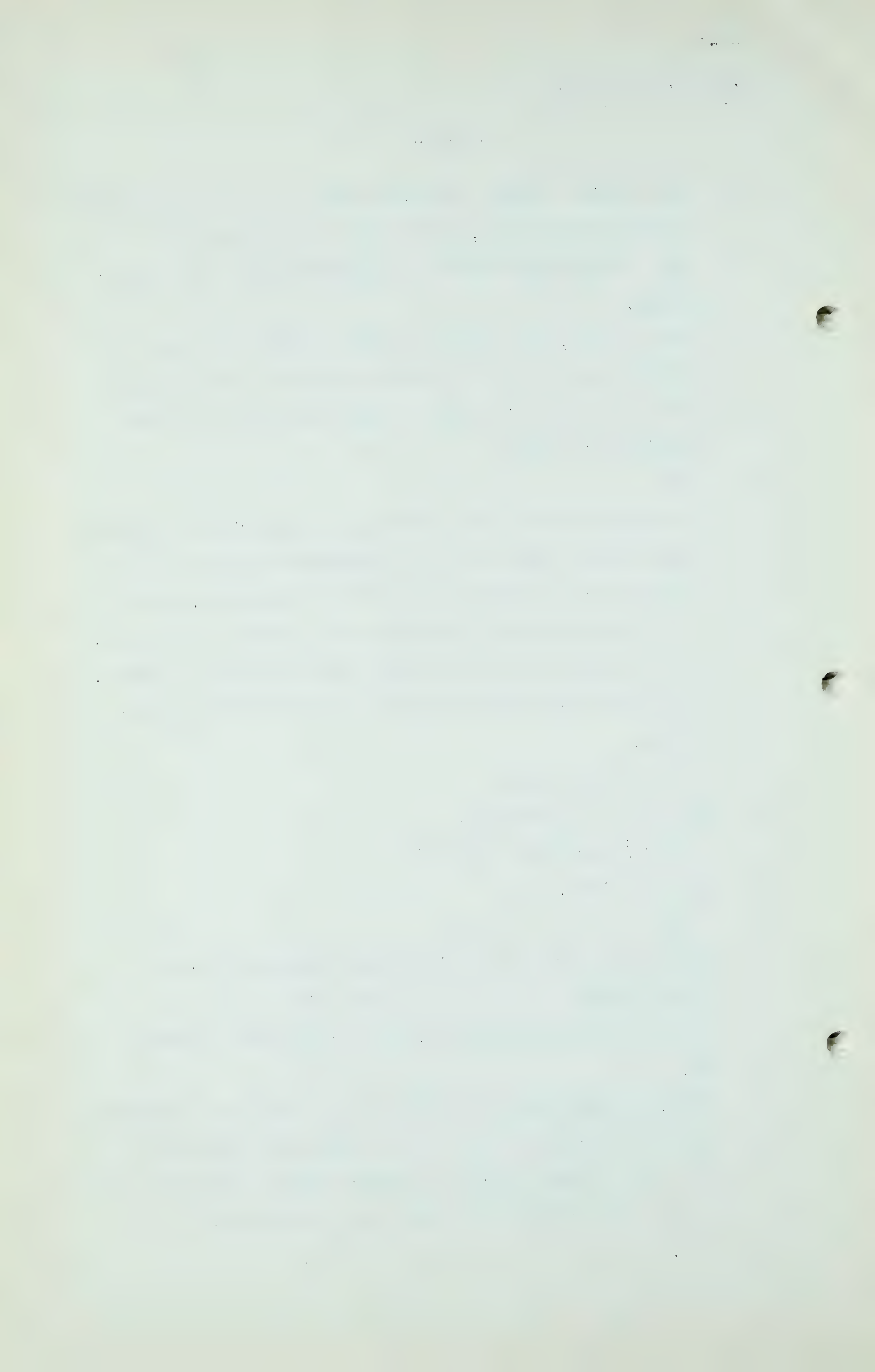
A That is right.

Q Yes?

A Now, in the event of no injection taking place in Golden Spike, I would say that 35 billion would not be economically gatherable, and I would have ignored it.

Q Well, Mr. Liesemer, is it fair to say that your estimates are on the whole, or on the average, or by and large, at a much lower figure, are lower than the average of the other gentlemen who have made estimates?

A Yes.



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Q And you perhaps will agree with me that they were gentlemen who have experience and knowledge and judgment?

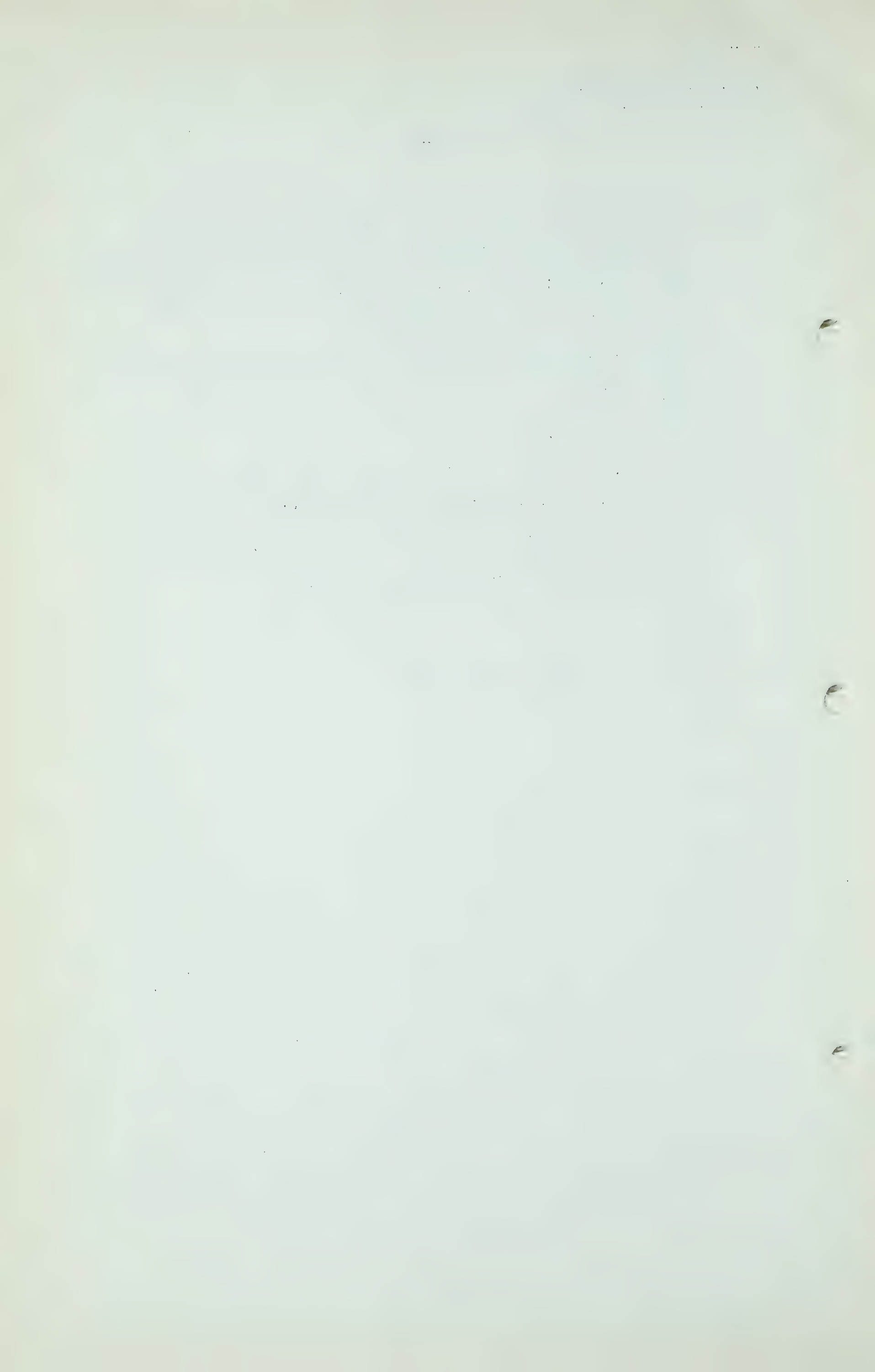
A They have certainly had experience. I do not know whether it is in Alberta or not.

Q And by experience you mean experience in fields other than Alberta?

A That is correct.

Q Thank you. I did not ask to have this marked. It is only for the convenience of the Board and counsel. I am not putting in evidence at this stage. I left it with the Board for its convenience.

(Go to page 914)



G.E. G. Liesemer,
Cr. Ex. by Mr. Fenerty.
Cr. Ex. by Mr. McDonald.

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CROSS-EXAMINATION BY MR. FENERTY:

Q There was one thing that struck me, Mr. Liesemer, in connection with Pincher Creek, you remember I was discussing that with Mr. Galloway. I think I am right, and if you take Mr. Galloway's acreage, Dr. Hume's thickness and the Gulf's porosity you come to 748 billion against your 771 billion. I wonder if you would call that an average figure under those circumstances?

A I might state here that these two well fields, speaking now with reference to Jumping Pound and Pincher Creek, are not very reliable. We have also had some experience with regard to that. During the course of the Dinning Commission we heard a lot about these Church Buttes or Church Butte, I think they are called the Church Buttes in Wyoming, and I remember hearing the testimony of Mr. Herring with regard to them, and, in fact, at the time of the Dinning Commission we were warned with regard to that. And with regard to the Church Buttes in Wyoming Mr. Herring said, I think it was, that they had hoped for a recovery of 3 trillion cubic feet, and now they are down to 700 billion, so that I think that we should forget these fields that have two wells, and should approach them, I mean we should approach them with considerable caution, having regard to all the experience we might have from other areas.

CROSS-EXAMINATION BY MR. McDONALD:

Q I was just interested, Mr. Liesemer, in your reference on page 1?

A Yes.



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Q Wherein you said "It has been arbitrarily assumed that, in general, any reserve of less than 20 billion cubic feet of marketable gas can not be economically gathered." Now, you explained, I believe, that you derived that figure from the report of, who was it?

A That is the exact quotation from the Smith & Wimberly report.

Q That is an exact quotation from the Smith & Wimberly report?

A Yes.

Q And the report that was made to the Federal Power Commission was prepared by Golyer & McNaughton?

A That is correct, Dr. Golyer and McNaughton.

Q For the American Gas Association, I believe?

A Yes.

Q And they were dealing with other gas fields, I mean, they were dealing with every gas field in the United States of America, were they not?

A As I understand it, yes.

Q So that instead of dealing with a good many thousands of gas fields, they derived a figure at which they were going to cut off their investigation?

A Yes.

Q So that in considering the gas reserves of the United States which they calculated to be some 170 some trillion cubic feet, they used this figure as their base, but when you come to the profits of Alberta, where you have very very little in comparison to the total area of the United States, you found this was still applicable here, is that correct?



G. E. G. Liesemer,
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A Well, the whole problem, as I understand it, for the purposes of this joint hearing was to consider that which could be exportable, whether there was an exportable surplus. I cannot see any point to consider anything which could not be economically gathered.

Q Is it a matter of things being relative. For instance, Dr. Nauss worked at some great length and placed before the Board the evidence with regard to the Brandi No. 1 well?

A Yes.

Q And I understood him to say that the reserves of that well are required to keep the system at Athabasca operating this winter. Do you know anything about that?

A Are they using the Brandi well for the Athabasca system?

Q Yes.

A I did not know that.

Q Then, again, you mention Morinville, and a gas system can be placed in Morinville, within between one and two miles, in that area?

A I have no knowledge of that either.

Q But you would agree that to be a desirable thing?

A Yes.

Q Wouldn't it be desirable to place that information before the Board as being part of the gas which will serve Alberta before export is granted to other companies?

A I gave that information to the Board, the reserves applicable to those two wells.

Q I am thinking of putting them in the record so all and sundry can read it?

G. E. G. Liesemer,
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A I do not believe that adding these little discoveries, all these little discoveries on the basis on which I gave the reserves would affect my total very much.

Q No, I am thinking of the recovery of the reserves and their usefulness to this Province?

A I have ignored Lloydminster and Vermilion and all the small-town utilities for that purpose as having no bearing whatsoever on the purposes of this Inquiry.

Q All of those items should not be ignored when this Board considers what gas is required for the purposes of the people of Alberta?

A Yes, but let me make this clear, apparently the whole thing hinges upon how much gas the two systems, Canadian Western and Northwestern Utilities, will require, and anything outside of that bears no relation whatsoever to the problem.

Q Yes. The problem, as I see it, is first, to establish before this Board what gas is available for the people of Alberta, both now and in the future, and then, secondly, to the best of the ability of the respective parties interested, to point out what would be available for export elsewhere?

A Yes, but what would be a lovely source of supply for a small town, or a small system, might be virtually worthless for a large long-distance transmission system.

Q I was pointing out that that is something that this Board should take into consideration in deciding what the Alberta situation is?

A That is up to the Board.

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Cr. Ex. by Mr. McDonald.

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Q So that what you have done, you have attempted to deal with this, not in the over-all picture, the way that the other geologists here or petroleum engineers have done, but you have dealt with it in a different way and have taken a much lesser approach?

A I have dealt with quantities that I could say were economically gatherable.

Q Now, let us deal first with Pouce Coupe. I think I can do it in 5 minutes, since you and I have already discussed this:

A Yes.

Q Now, I have taken and had inserted in J-29, filed by Dr. Nauss, the structure contour map of the Pouce Coupe gas field, and it is Plate 9. Have you got a copy of that available?

A No, I haven't got it. I will have to quote from memory now.

Q I gave them all away. I haven't any myself.

MR. C. E. SMITH: I will give you a copy of it.

Q MR. McDONALD: Will you go to Plate 9?

A Yes.

Q Now, you will notice - you know also that Dr. Nauss has been the, or was, the geologist for the Peace River Natural Gas Company and the Pacific Petroleums?

A Yes, correct.

Q And he is now a consultant to those companies?

A Yes.

Q And that there have been a number of wells that he sets out in his report actually drilled in those areas by the Peace River Natural Gas Company?

G. E. G. Liesemer,
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A From memory that looks like the exact number of wells we use for our contour maps, yes.

Q There is only one thing I would like to bring to your attention.

A Yes.

Q As with our previous discussions the difference between you was that you used a 120-foot contour and Dr. Nauss has used a 140-foot contour in regard to the area which he has based his estimate on?

A That is right.

Q Is that right?

A I used 120.

Q Now, Mr. Liesemer, - I do not seem to have one.

MR. C. E. SMITH: What are you looking for?

MR. McDONALD: I am looking for Dr. Nauss' report. I have given every one away, and I haven't got one for myself.

DR. GOVIER: Mr. McDonald, here is one.

MR. McDONALD: It is the other one, Exhibit J-29, Dr. Govier.

MR. MARTLAND: Here is one.

MR. McDONALD: Thank you.

Q If you will locate the Peace River Alberta No. 2 well, Mr. Liesemer?

A P.R.A. No. 2?

Q Yes? That is practically on the 120-foot contour. I think the gas was producing from the 118-foot?

A I haven't got it here.

Q But if you will go back to the structural contour map,

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that is right, isn't it?

A Yes. We had the same discussion in Edmonton, if I recollect.

Q Yes. And the well has a measured open flow of 23 million 900 thousand?

A I do not remember the details. There were two other good wells, if I recollect, there.

Q And this was one of them?

A Yes, I think so.

Q Now, the open flow which Dr. Nauss sets out on page 18 of Exhibit J-29, I think, is the original measurement, and then by the application of back pressure tests on that well there was also a very substantial production?

A One thing is missing on this map, and that is the location of that P.R.N.G. Wilrich.

Q I think Dr. Nauss put that in when he was discussing that map this morning?

A Yes.

Q But if this one well produced that amount of gas just a foot and a half above your contour line, why did you take a lower contour line?

A You will remember the evidence I gave in Edmonton, Mr. McDonald. My contour line was based on P.R.N.G. No. 6, which actually found water at -80.

Q Don't you think if you had the biggest well on the field at that place that you should have the contour line somewhere else?

A I do not know. It might be entirely different how you would describe the reservoir. One of the things that

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came up in the Basal Quartz member at the Morinville was the water level.

Q What kind of water level are you taking at Morinville?

A The bottom water level.

Q Did you see the electrologs put in by Dr. Nauss?

A I have seen some and I have one myself I read.

Q And isn't the water referred to there below the shale break?

A There is a water level above the shale break, but as far as that is concerned I am talking about the Basal Quartz member below the ostracod.

Q Which one are you referring to in the Morinville below the shale, in your Basal Quartz member?

A That is the one.

Q Well, we will deal with that again. But you have at least 11 wells here?

A Yes.

Q On which you have established a contour map, you still say that using, that you should use a 120-foot contour in that area regardless of the fact that you have the largest producing well in that field at $118\frac{1}{2}$ feet?

A I struck an average there. One of the wells hit water at -80.

Q Now, there is just one other matter, sir, that I would like to ask. With regard to Pincher Creek the only seismographic information that you have on Pincher Creek would be supplied by Canadian Gulf?

A That is right.

Q If I recall that, and the map that was put in yesterday,

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it showed that the southeast end had not been defined?

A I am not too sure about that. I would have to look at the map.

Q I am suggesting to you also when you make your deductions of 25% you have not taken into consideration the fact that the structure is still not defined?

A Oh, I see what you mean. In other words, on Mr. Gray's submission, that there might be more gas in there?

Q Yes, in the others?

A Two wells on a structure like that, yes, but right now it is only tentative.

Q You were here when he gave his evidence?

A Yes, I heard it.

Q That is all I have at this time.

THE CHAIRMAN: We will adjourn until the morning.

MR. STEER: Before you adjourn, Mr. Chairman, I promised to put in an average of 44 Kinsella wells, an average curve for 44 Kinsella wells. May I tender that now?

THE CHAIRMAN: That will be Exhibit No. 44.

MR. C. E. SMITH: Do you know all about them?

MR. STEER: I wish I knew anything about them at all.

SUBMISSION CONTAINING AVERAGE
44 KINSELLA WELLS MARKED
EXHIBIT J-44.

(Hearing adjourned until 9.30 A.M. November 10, 1950.)

to answer the question and not to be satisfied
I do not see how you can. I would have to look at

I am suggesting to you that you make your suggestions
of the fact that the committee has been looking
for evidence in all the papers

Yes, I am sure you will. The committee is not
satisfied with the evidence that is there

The committee is not satisfied with the evidence
that is there. It is only evidence

You were here when the committee was

Yes, I heard it

That is all I can say at this time

The committee is not satisfied with the evidence
that is there. It is only evidence

The committee is not satisfied with the evidence
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Yes, I heard it

THE COMMITTEE IS NOT SATISFIED WITH THE EVIDENCE
THAT IS THERE. IT IS ONLY EVIDENCE

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